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PLANTATION HARD CURE.

Peradeniya, December 15, 1913.

Some years ago MR. WICKHAM wrote to Ceylon offering to come out and demonstrate how up-river hard cure rubber was prepared. The authorities in Ceylon replied that they did not think they had anything to learn from the crude methods practised by the natives of the Amazon and further that they had discovered a much better process of coagulation, viz., by acids. It is to be observed that MR. WICKHAM did not propose a new method of his own but to apply that of the Amazon curers. For two decades he continued to urge the advantages of this method and, in July 1912, he had the satisfaction of seeing a piece of rubber prepared at Peradeniya by a machine he had invented for the mechanical application of the Amazon method. This method consists of directing a hot blast of smoke on to the crude latex ; the apparatus being constructed and worked in such a way that the latex is introduced in thin layers, each layer being coagulated before the succeeding one is superimposed. Other necessary factors for the success of the method as mechanically applied are that the current of smoke should be constant in volume and that it should be confined and under control so that it may not pervade the building to the injury of the eyes of the operators.

MR. WICKHAM introduced one innovation. After the rubber had been cured in his apparatus he folded it up and put it into a press leaving it under high pressure for 24 hours or so until it was consolidated into a block.

The announcement that the blocks which MR. WICKHAM took home with him in April of this year had attracted the attention of dealers, merchants and manufacturers in London, has stimulated interest in the preparation of rubber and encouraged planters to devise new methods of preparing rubber by smoke. We do not feel sure that this latter result is

altogether a happy one. Perhaps the last thing the industry requires at the present time is the introduction of a diversity of methods, and the success so far of the Wickham process should we think have had the effect of concentrating on the endeavour to adapt the Amazon method to plantation requirements. The solution of this question is a matter for engineers and it is satisfactory to record that Colombo engineers are applying themselves to it. One condition necessary for success is thoroughly to grasp the essentials of the Amazon method. Unless that is done, we do not see how that method can be successfully imitated. Another point is that the apparatus, whatever it is, must be capable of dealing with large quantities of latex daily and to be easily operated. It may be that the cured rubber may be rolled up under tension, instead of being blocked in a press, and if so this will simplify the process considerably. It is possible too that instead of being either pressed or rolled it will be taken from the curing apparatus and creped into blanket. At the same time it is necessary to point out that the favourable reports received were for blocks.

There is no suggestion that new methods of preparing rubber should not be investigated or that research work should in any way be discouraged or that the preparation of pale crepe for which there will always be a market, should be abandoned. Methods very much better than any now known may come to be discovered. But the prospect of that should not be allowed to obscure the fact that at present the market as reflected by the price of Para seems to favour, not new methods, but an old one.

It should be recorded in connection with this question that experiments were made at the Government Experiment Station in 1906 on the blocking of wet rubber after the addition of creosote dissolved in spirit, the object being more nearly to approach the conditions of manufacture of Hard Para, by preventing the putrefaction of the proteids, and allowing the rubber to be shipped with sufficient moisture to permit of full maturing without decomposition. The experiments were successful and further samples made on similar lines at Culloden and on a larger scale were shown at the London Rubber Exhibitions in 1908 and 1911 receiving the general approval of both British and Continental Manufacturers.

Samples of rubber at Peradeniya cured some months ago by the Wickham machine are difficult to distinguish from a sample of Amazon hard Para lying on the table alongside them. The grading of plantation so far as it depended upon colour would no longer be necessary for hard cure, as it turns brown and eventually black on the outside, remaining white inside. This takes us some way towards standardization.

R. N. L.

RINDERPEST AND SURRA.

A description of the work of the Imperial Bacteriological Laboratory, Muktesar, by MAJOR HOLMES, the Imperial Bacteriologist, has been received from the Superintendent of Government Printing, Calcutta.

The contents of the publication, which is accompanied by a number of illustrations, consist of (1) a history of the laboratory, (2) a description of the site and buildings, (3) research work and publications, (4) the practical application of serums and vaccines, (5) the products of the laboratory.

The research work has so far dealt with Surra, Rinderpest, Epizootica, Lymphangitis and Dourine; while anti-serums were prepared against Rinderpest, Hœmorrhagic Septicœmia and Anthrax, and a double vaccine for Black quarter.

The use of serum in rinderpest has proved of great value in protecting cattle and controlling the spread of infection. Immunity lasts for only two or three weeks, but it has been found that animals exposed to infection after injection within the protective period, contract a mild attack which gives immunity of long duration. Immunised animals cannot act as media for the existence and transmission of the disease, and so by increasing the number of immune cattle the use of serum would tend to ultimately eradicate disease.

In Hœmorrhagic septicœmia serum is useful in protecting animals exposed to infection while the disease prevails and until definite action could be taken in carrying out disinfection and detecting the source of infection.

As regards Surra it is announced that a successful cure of the disease in horses by means of Arsenic and Atoxyl has been worked out, and full instructions are given for treatment.

It will thus be seen that the laboratory is engaged in a most useful work, the results of which should prove of great value to this colony as well as to India.

C. D.

CABINET TIMBERS OF AUSTRALIA.

This is the title of an elaborately illustrated manual issued from the Technological Museum, Sydney, by MR. R. T. BAKER, Curator and Economic Botanist. The work contains an exhaustive description of each timber tree, its botany, geographical range and utility; while the illustrations show sections of the timber in their natural colours and also reproduce photographs to illustrate how it is employed.

Foremost among the cabinet woods is placed the "Red Cedar" (*Cedrela Toona*) which the author refers to thus: "Taken all in all, it is considered the best all round timber in Australia." Our readers will recognise in this the familiar Toon Tree of upcountry estates for which, together with the Grevillea, Eucalyptus and Acacia (wattle) we are indebted to Australia.

The following are given as the finest woods which belong to the first class of cabinet timbers:—Blackwood (*Acacia melanoxylon*), Maple of Queensland (*Flindersia chatwaiana*), Maple of New South Wales (*Villaesia Moorei*), Silky Oak (*Grevillea robusta*), Walnut (*Cryptocarya Palmerstoni*), Red Bean (*Dysixylon Muelleri*) and Jarrah (*Eucalyptus margineta*); but of course there are many others almost equally as good.

It is somewhat of a surprise to find what is called the White or Golden Cedar (Melia Azedarach) referred to as a cabinet timber. This is our Persian Lilac or Indian Bed Tree, common in Colombo gardens and bearing flowers which resemble the Heliotrope both in colours and odour. With us the tree only serves an ornamental purpose and attains to no size.

After looking through this volume of original design, one cannot but wish that a similar work showing colour illustrations of our Tropical Timbers, many of which are very beautifully grained and marked, may be compiled to illustrate the natural resources of the Colony in this respect.

C. D.

THE CULTIVATION OF VANILLA.

P. ADVISE-DESRUISSEAUX

In growing vanilla, it is important to gather the fruits in their optimum state of ripeness, as otherwise the prepared product has a lower market value.

The writer sums up the characters of vanilla ready for preparing:

(1) whole surface dull;

(2) both lateral lines yellow;

(3) the lines below the epidermis yellow or yellowish green, giving the whole fruit a slightly yellow tinge of green.

In these conditions: (1) the vanilla is sufficiently ripe; (2) it can hang some time, which allows the pickings to be spaced out, so economizing labour, the "yellow tip" criterion is not a guarantee of ripeness, and entails more frequent pickings.

The planter should attempt to obtain a product as heavy as is compatible with quality; the writer has therefore investigated the influence of cultural methods on the density of the pods. He finds that fruits ripened in the shade are denser than those ripened in the sun; the loss of sun-ripened pods is 4 per cent.

To obtain heavy pods, if the supporting trees will not keep their leaves till after the fruit is picked they should be headed back two or three months after they come into leaf; the physic-nut (*Jatropha curcas*) is useful as a support.

In very moist countries, vanilla ripened in the sun is found to be richer in perfume than that ripened in the shade. In this case the planter must decide what pays him best.—MONTHLY BULLETIN.

RUBBER.

THE SLOPE OF THE TAPPING CUT.

In a recent bulletin on Hevea tapping, DR. A. W. K. DE JONG has, among other things, dealt with a point which is often overlooked. It is that the amount of bark removed per annum, or the number of cuts to the inch, depends upon the angle which the tapping cut makes with the vertical channel.

Suppose, for example, that the tapper is using a knife which can be adjusted so as to remove a definite breadth of cortex at each cut, and that it is desired to put on twenty cuts to the inch. The first impulse would doubtless be to adjust the knife so that it should cut off a strip one-twentieth of an inch wide. But that would not give twenty cuts to the inch reckoned vertically. The thickness of the strip removed is measured perpendicularly to the tapping cut, and hence twenty cuts to the inch, with the knife adjusted as stated, would remove one inch perpendicular to the cut. What that amounts to, reckoned vertically, depends on the angle of the cut. Only if the cut were horizontal would the removal of strips, each one-twentieth of an inch wide, give twenty cuts to the inch reckoned along the vertical channel.

Now, in marking out the trees, the distances are measured along the vertical channel. Therefore, if any one calculates that by removing a strip one-twentieth of an inch broad per tapping, and placing the cuts 1 foot apart along the channel, he will be able to tap for 240 days, he will find himself sorely disappointed. It is readily seen that the parallel-sided strip removed in tapping is cut obliquely by the vertical channel, and hence the length which is removed vertically is always greater than the thickness of the strip. If the angle of the tapping cut were 30°, then twenty cuts to the inch, removing a strip one-twentieth of an inch thick each time, would remove two inches reckoned vertically.

That this point is frequently overlooked is evident from a recent compilation which includes elaborate tables giving the amount of bark removed per annum in daily or alternate day tapping, for strips of given thickness, regardless of the fact that in actual practice the thickness of the strip is measured perpendicular to the cut, while the amount of cortex removed is measured along the vertical channel.

This fact was recognised in "Bowman and Northway's marker" which consisted of a tin isosceles right-angled triangle, with its hypotenuse 2 feet in length and each of the other sides 17 inches. Distances of 17 inches, measured along the vertical channel, give cuts one foot apart measured perpendicular to the cut, if the angle is 45°.

DR. DE JONG has carried out an experiment which shows completely the relation between the amount of bark removed and the angle of the cut. Three groups, of ten trees each, were tapped by the same tapper for the same

period. In the first group the tapping angle was 36°, in the second, 42°, and in the third, 56°. The vertical strips of cortex removed in the same number of tappings measured 302, 288 and 270 centimetres respectively. These are in the ratios of 1:0.95:0.89, while the ratios which should theoretically have been obtained are 1:0.9:0.7. In general terms, the steeper the cut, the greater the amount of cortex removed, reckoned vertically.

It may be suggested that this fact may account for the differences of opinion regarding the number of cuts it is possible to make to the inch. Some authorities state that twenty-four should be obtained, while others regard eighteen as good. The difference might be accounted for, if it were the practice to reckon the cuts across the tapping surface in the one country, and along the vertical channel in the other. For, with an angle of 45°, twenty-four cuts to the inch reckoned perpendicularly to the cut, is seventeen cuts to the inch reckoned along the vertical channel.

T. PETCH.

THE RUBBER POSITION.

A well-known firm of rubber share-brokers has compiled the following statistics forecasting the production and consumption of rubber till the year 1921. They seem drawn on reasonable lines. Production is taken at 100 lb. per acre for 4-year trees, rising to 400 lb for ten years' growth.

PLANTATION PLANTED ACREAGE.

	1908.	1909.	1910.	1911.	1912.	1913.
Malaya	241,000	292,000	362,000	542,000	622,000	—
Ceylon	180,000	187,000	200,000	210, 00	220,000	—
Netherlands India	90,000	120,000	185,000	200,000	230,000	—
India and Burmah	30,000	31,000	30,000	40,000	40,000	—
Borneo	10,000	10,000	12,000	20,000	20,000	—
Acres	551,000	640,000	789,000	1,012,000	1,132,000	1,245,200 (estimated).

PRODUCTION AND CONSUMPTION—1. ACTUAL.

WORLD'S PRODUCTION IN TONS.

	Plantation.	Brazil.	Rest.	Total.	Tons.
1905 ...	145	34,000	26,800	61,000	61,000
1906 ...	510	36,000	29,500	66,000	66,000
1907 ...	1,000	38,000	30,000	69,000	69,000
1908 ...	1,800	39,000	24,200	65,000	65,000
1909 ...	3,600	42,000	23,400	69,000	68,500
1910 ...	8,200	40,500	21,300	70,000	66,000
1911 ...	14,100	39,500	22,400	76,000	73,000
1912 ...	28,500	40,500	30,000	99,000	98,000

2. ESTIMATED.

	Plantation.	Brazil.	Rest.	Total.	Tons.
1913 ...	42,000	41,000	32,000	115,000	112,000
1914 ...	64,000	40,000	20,000	124,000	126,000
1915 ...	94,000	38,000	10,000	142,000	142,000
1916 ...	121,000	35,000	5,000	161,000	159,000
1917 ...	147,000	32,000	2,500	181,500	179,000
1918 ...	166,000	30,000	nil	196,000	197,000
1919 ...	183,000	30,000	,,	213,000	216,700
1920 ...	198,000	30,000	,,	228,000	238,370
1921 ...	209,000	30,000	,,	239,000	262,200

THE EFFECT OF MANURING ON THE GROWTH OF HEVEA.

The following account of experiments instituted in Java to determine the effect of manuring on the girth increment of Hevea has been published by DR. A. W. DE JONG (Meded. van het Agricultuur-Chemisch Laboratorium, No. 4).

336 untapped trees, five years old, were experimented with. These were divided into groups of four, and adjacent groups were manured in different ways. In that way groups manured in the same way were distributed over the whole plantation, so that differences in the soil were to some extent counterbalanced, though that arrangement was perhaps necessitated by the fact that different parts of the field were planted at different distances.

The field was divided up by trenches, a foot and a half in depth and a foot broad, so that each tree stood in an isolated square. The trees were manured in circles at a distance of one metre from the stem. DR. DE JONG points out that a better arrangement would be to manure rows of trees which are separated from another by unmanured rows.

The following manures were applied per tree in the different experiments:

Experiment 1. Double superphosphate 30 gr.
,, 2. Double superphosphate 30 gr. + Potassium Chloride 10 gr.
,, 3. Double superphosphate 30 gr. + Ammonium Sulphate 10 gr.
,, 4. Double superphosphate 30 gr. + Potassium Chloride by Ammonium sulphate 10 gr.
,, 5. Potassium Chloride 10 gr.
,, 6. Potassium Chloride 10 gr. + Ammonium sulphate10 gr.
,, 7. Ammonium sulphate 10 gr.
Control 8. Unmanured

Counting the control, the series of experiments required eight plots, and as the total number of trees was 336, each manure was applied to 42 trees which were distributed over the field in $10\frac{1}{2}$ groups of four.

The manures were applied in April 1911 and again in July 1911, the trees being measured in November. In November 1911, the trees were again manured, the quantities applied being this time doubled, and this application was made again in January 1912. Measurements were taken in April 1912.

In May 1912, the trees were again manured, the quantities being increased to 50 grams double superphosphate, 50 grams Potassium Chloride and 100 grams Sulphate of Ammonia in each case, and this dose was repeated in August. Measurements were taken in November 1912.

The *total* extra increase in girth (in centimetres) as compared with the control plots, *for each 42 trees*, at intervals of 6 months, is given in the following table. The figures are exclusive, and should be added together to obtain the total extra increase for the eighteen months, and it should be remembered (a) that the quantities were altered between the dates of measurement, and (b) that the six month periods are not comparable because one (or two) of them includes the "wintering" period, when the trees are not increasing in girth.

	Nov. 1911.	April. 1912.	Nov. 1912.
1. Double Superphosphate	6	15	24
2. „ „ + Potassium Chloride	4	7	9·5
3. „ „ + Ammonium Sulphate	6	11·5	26
4. „ „ + Potass. Chlor. + Amm. Sulph.	17	39	53
5. Potassium Chloride	11·5	13·5	26·5
6. „ „ + Ammonium Sulphate	13·5	24·5	49·5
7. Ammonium Sulphate	12·5	38·5	47

The Complete manure (Expt. 4) gave the best result, while the effect of Ammonium Sulphate is only slightly less. Phosphoric acid with nitrogen (Expt. 3) gave a smaller increase than nitrogen alone (Expt. 6).

T. PETCH.

HEVEA RUBBER FROM CEYLON.

In previous numbers of the IMPERIAL INSTITUTE BULLETIN (1911, *9*, 300, 406; 1912, *10*, 496) reference has been made to tapping experiments carried out in Ceylon with the object of ascertaining the most suitable interval between successive tappings. Seven samples of the rubber obtained in the course of these experiments were received at the Imperial Institute for examination Each sample consisted of a number of biscuits and represented the rubber prepared from a row of trees tapped at intervals of one, two, three, up to seven days respectively.

The samples exhibited good physical properties on the whole, but a few of the biscuits were rather weak. The results of the chemical analyses are shown in the following table:—

PERCENTAGE COMPOSITION OF DRY WASHED RUBBER.

	Caoutchouc.	Resin.	Protein.	Ash.
No. 1	95·7	1·7	2·3	0·3
No. 2	95·4	2·5	1·9	0·2
No. 3	96·1	1·7	2·0	0·2
No. 4	96·3	1·8	1·7	0·2
No. 5	96·0	2·0	1·8	0·2
No. 6	96·3	2·0	1·5	0·2
No. 7	96·3	1·8	1·7	0·2

It will be seen that all the samples were of very good quality, so far as composition is concerned, and it is of interest that the rubber obtained by tapping at intervals of three to seven days contained a little more caoutchouc than the rubber obtained by tapping every day or every other day.—BULLETIN OF THE IMPERIAL INSTITUTE.

HEVEA AT THE PERADENIYA EXPERIMENT STATION.

Plants in plots 14 and 15 from seed of No. 2 tree Heneratgoda have been well mulched with *Indigofera arrecta*, cut from that sown broadcast amongst them in June, this being the first cutting. The young trees are looking very well responding to cultivation and mulching.

Plots 65-67 sown with green-gram has had this ploughed in after two pickings and gram will be resown. The new "Hill-top" (11½ acres) and Hill-side (7½ acres) clearings will be supplied this month. The *Tephrosia candida* is ready for cutting and mulching on the Hill-top but that on the Hill-side nearly all died out owing to drought. It will be resown.

The big Wickham Smoke curer at Heneratgoda is in full working order turning out an average of 6 lb. wet rubber in 30 minutes.

The rubber is made into blocks weighing about 6 lb. and experiments are being made as to the best method of pressing so as to get the block in uniform layers.

A consignment of 574 lb. consisting of blocks, roll, ribbon, and crepe, made at Peradeniya from December 1912 to April 1913, has been sent to the Imperial Institute for report.

The smaller model from here has been sent down to MR. CAMPBELL at Gikiyanakanda to experiment with.

D. S. CORLETT,
Manager.

CACAO.

THE FOOD VALUE OF CACAO.

The "NEW YORK TEA AND COFFEE TRADE JOURNAL" for October last contains instructive reading with regard to cacao as a valuable food substance which should be more generally known, especially in the Tropics where one is exposed to so many debilitating conditions tending to reduce one's energy and vigour. In the U. S. of America its popularity has so increased that from 18 million lb. in 1890 it has risen to 140 million lb. in 1913, or $7\frac{1}{2}$ times as much during the period while tea has risen by only 20%. About the middle of the 19th century MITSCHARLICH undertook to examine cacao as to its composition and the chief physiological action of its constituents. He was of opinion that cacao should be given the preference over coffee and tea which in no sense are to be regarded as food substances, as it contains the same nutritive substances as flour, and also a considerable amount of fat of a pleasant flavour: so that it is practically the only substance which approximates dry milk and therefore is, like milk, a perfect food. Like milk also it is capable of serving all the food wants of man, if not continuously at least for periods of considerable lengths. MOLESCHOTT states in one of his works that RICHELIEU in his later years owed his health and activity to the use of chocolate, while STOLLWERCH adds that modern science has completely confirmed all the conclusions of the earliest investigations of cacao and chocolate. Both these substances are to be regarded not only as savory and nerve-stimulating articles of consumption, since their valuable properties as rich food substances and particularly their beneficial action upon the human organism are universally recognised.

HARNACK has scientifically demonstrated the complete harmlessness of cacao to the stomach, heart and nerves, so that it may continually be drunk by children as well as by weak and sick persons without the least damage. The albumen content of ordinary cacao with a medium percentage of cacao butter is about 25% which is equal to that of medium fat beef; while the amount of easily digested cacao fat is 5 times that of beef. Eggs contain about 12% of albumen and fat, about half as much as is contained in cacao which moreover contains a valuable ingredient in calcium phosphates.

According to DR. BIDDIES, PROFESSOR NEWMANN and other investigators, the coefficient of digestibility of cacao in the human organism is very high and it can be regarded as established that cacao in general exercises a favourable influence upon the resorption of other food substances in the human body, particularly the fats.

C. D.

COCONUTS.

THE FLOWER OF THE COCONUT.

A perusal of the numerous books on the coconut, which have recently appeared in anticipation of the expected boom, will show that although their authors have gathered together all the available data on the subject, they have not been able to give much information about the flower. The details of its structure are of course well-known to botanists, though even that knowledge does not appear to have become sufficiently widely diffused to influence popular opinion. But with regard to the biology, or life history, of the flower, very little has been recorded.

The "flower" of the coconut, using the term in its popular sense, first appears between a leaf and the stem, as a spear-shaped flat structure. At this time it is completely enclosed in a continuous covering which is known as a spathe. It takes several weeks to attain its full length, and meanwhile it gradually becomes more cylindrical, especially in the upper half. When full grown, the spathe splits longitudinally down the side which faces outwards, and the flower opens out. The splitting usually begins at a point near the apex and takes several hours to complete ; it may take more than twenty-four hours.

To avoid confusion we must now alter our terms and use some of the long words which are supposed to be the special failing of the botanist The "flower" of the coconut is not a simple flower, but a collection of flowers, and the whole collection is an "inflorescence." The inflorescence is branched, and each branch bears numerous flowers. When the inflorescence is enclosed within the spathe, the branches lie close to the main axis, and the whole is so tightly packed that it is quite impossible for any of the individual flowers to open before the spathe splits. Sometimes a few of the flowers expand as soon as the spathe splits : at other times none open until the branches of the inflorescence have spread out.

THE MALE FLOWER.

A coconut inflorescence bears, as a rule, two kinds of flowers, male and female. The male flowers are crowded together, from the tips of the branches downwards, and these are the first to open. Each male flower has six floral leaves, three small and three large, which spread out in star fashion. Within these are six stamens which provide the pollen necessary for the fertilisation of the female flowers. And in the centre of each male flower is a short column which terminates in three small teeth, at the base of each of which is a nectary. The male flowers are borne in hundreds, or even thousands, on each inflorescence.

THE FEMALE FLOWER.

The female flowers are situated lower down the branches of the inflorescence than the males, and there are comparatively few of them. On young trees at Peradeniya, while the number of male flowers on an inflorescence runs into thousands, there are not more than about a dozen female flowers and there may be none at all. When the inflorescence opens, the female flowers are seen as more or less spherical bodies, somewhat resembling nuts, and hence the idea has arisen that the flower has been

fertilised and the nut formed, before the inflorescence opens. As will be evident later, that conception is quite erroneous.

The female flower, like the male, has six floral leaves, but they are much larger and thicker. When the inflorescence opens, these floral leaves are tightly folded over the inner part of the flower and completely hide it. They are so tightly wrapped over that the outside, at first glance, appears to be continuous, and that is the reason why the female flower has been thought to be the fruit. Inside the floral leaves is an oval body composed chiefly of the tissue which will develop into the husk of the fruit, while the embryo coconut is a minute structure at the very base of this. After the inflorescence opens, but before fertilisation has taken place, this mass of tissue continually increases in size and ultimately forces apart the floral leaves, disclosing only its rounded upper surface which is surmounted by a white nipple. This nipple is marked by three equidistant grooves which meet at its apex and thus divide it into three triangular sections. When the female flower is ripe, these three segments separate and stand erect as three teeth, exposing the stigmatic surface on which the pollen must fall in order that the flower may be fertilised. These three teeth constitute the stigma. It is impossible for fertilisation to occur before the stigma is ripe, and that does not happen until long after the opening of the inflorescence. The stigma ultimately turns brown and the tissues round it collapse, forming a small black more or less circular area containing three shrivelled teeth, at the apex of the young fruit. The six floral leaves do not increase much in size, but form the whorl of small "leaves" at the base of the fruit.

Of the accompanying figures, A shows the young unopened female flower, with its floral leaves still folded closely over it; B shows a fully opened female flower, ready for fertilisation.

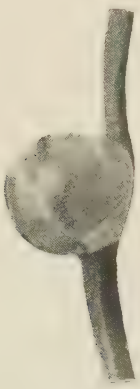

Fig. A.
Young unopened female flower.

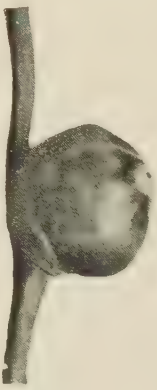

Fig. B.
Fully opened female flower.

THE BIOLOGY OF THE FLOWER.

With regard to the details given in the following paragraphs, one or two points must be borne in mind. They are the results of observations, for more than a year, on a young tree in its third year of bearing, at Peradeniya. Now, Peradeniya is situated near the upper limit for coconuts in Ceylon, and the growth of the trees is slower at that elevation than in the low country. Moreover, the course of events in the case of a young

tree differs to some extent from that on old trees. For these reasons, the data here enumerated will not be immediately applicable to coconuts in the low country. But the differences will lie in the *duration* of the various phases, not in their order. It is not to be expected that the sequence of events will show any variation. One of the chief inducements for recording the present details is the hope that someone more favourably situated will make similar observations in the low country.

POLLINATION.

"Pollination" is the application of the pollen to the stigma. As the pollen and the stigma are in separate flowers, male and female respectively, in the case of the coconut palm, there must be a transfer of pollen by some means or other from the male flower to the female. Now, when the coconut inflorescence expands the male flowers open first. (This, by the way, is not peculiar to the coconut, but is quite a common phenomenon in palms.) The inflorescence is then, if we consider the ripe flowers only, entirely male, and it continues entirely male until all the male flowers have opened and fallen off. At Peradeniya, on the tree under observation, this male phase lasted for from three and a half to five weeks.

After all the male flowers have fallen, a period of from two to five days elapses before the female flowers begin to open. These then begin to open at the rate of two or three per day, and during this time the inflorescence is entirely female. The duration of the female phase depends upon the number of female flowers: at Peradeniya, it lasted for from one to seven days. Each female flower is receptive for about twenty-four hours (or less); after twenty-four hours the stigma begins to turn brown.

It will be seen from the above how erroneous was the idea that the female flowers were fertilised before the inflorescence opened. Not only is that impossible, but fertilisation cannot occur until three or four weeks after the opening of the inflorescence. Moreover, it follows from the above data, that a female flower cannot be fertilised with pollen from a male flower of the same inflorescence, for all the male flowers have disappeared before the female flowers open.

Whence then is the pollen which fertilises the female flower derived? Well, the coconut, as is common knowledge, produces inflorescences in continuous succession, and if they appear rapidly enough, or if the flowering period of each is sufficiently prolonged, it may happen that, before one inflorescence has finished flowering, the next may have begun, and in that case it is possible that the female flowers of the first may be pollinated from the male flowers of the second. In other words, the flowering periods of successive inflorescences may overlap, and then the female flowers may be fertilised with pollen from another inflorescence on the same tree. In the tree under observation, overlapping occurred only three times during the year, in October 1912, May 1913, and September 1913. It may be more frequent in the low country, but this is one of the points which demand further observation. Failing this overlapping, pollination can only be effected by pollen from another tree.

This last point suggests interesting possibilities. Suppose, for instance, that in a given plantation, none of the inflorescences "overlapped," and that all the trees produced their inflorescences at the same time. There would then be no pollen available when required! It is evident that one condition for efficient pollination is that the different trees should produce inflorescences at different times, not all at the same time. How far is this fulfilled?

Do trees of the same variety in the same environment tend to flower at the same time? Do trees of different varieties tend to flower at different times? Is a plantation of mixed varieties more prolific than one of one variety only? And so on.

POLLINATING AGENTS.

How is the pollen conveyed from the male to the female flower? The pollen of the coconut consists of simple spherical grains without any special adaptations, and the structure of the male flower is, on the whole, equally simple. But the male flower possesses three nectaries at the bases of the teeth which crown the central column, and the secretion of these nectaries undoubtedly attracts insects. The stigma of the female flower also furnishes "nectar," so that the visits of the insects to both male and female flowers are assured. Bees and hornets appear to be the most frequent visitors, but further observations are required on this point.

In considering the potential insect visitors to flowers in the Tropics one has always to take into consideration the ubiquitous ant. At Peradeniya, a small black ant is common on coconuts, and at first sight it seems possible that this insect may take part in the conveyance of pollen from the male to the female flower, especially when the periods of the inflorescences overlap. In that case they might convey pollen from one inflorescence to another on the same tree. But it is improbable that they should convey pollen from one tree to another, because the journeys of this species, as a rule, do not extend to two trees.

There is, however, a special provision on the female flower of the coconut which more or less effectually excludes ants from the work of pollination. The region below the stigma, almost the whole of the area which is exposed when the female flower opens, bears a large number of pores. When the flower is ripe these exude a quantity of moisture which, at least in fine weather, forms a ring of liquid round the stigma and prevents the ants reaching the latter. It is not uncommon to see a crowd of black ants congregated round the edge of this ring. It is probable that, as is usual in cases of this kind, the liquid contains some sugar, so that the ants obtain what they want without robbing the stigma. In any case, it keeps the ants away from the stigma. The position of these water pores can be clearly seen on the young fruit, where they are indicated by small whitish spots. These spots owe their colour to masses of minute crystals which are deposited by the liquid.

As far as insect visitors are concerned, therefore, pollination is effected by bees and hornets. But from the structure of the flowers it is most probable that the wind is also responsible for the transference of pollen, to a great extent.

THE NUMBER OF FEMALE FLOWERS.

As has already been stated the male flowers far outnumber the females. The vast majority of the flowers on the coconut inflorescence are male. The tree under observation was probably below even the Peradeniya average, and bore only from one to thirteen female flowers on each inflorescence, but I have seen inflorescences even on older trees which did not bear any female flowers.

When a tree first begins to flower, the earliest inflorescences frequently bear male flowers only. One such tree at Peradeniya has already produced five inflorescences which were entirely male, and another two now in sight give every promise of being the same. Thus for the greater part of a year this tree, though flowering, cannot produce any nuts. If, as my information

stands, this occurs side by side with trees which bear mixed inflorescences from the first, it would point to a difference in jat, rather than a difference in previous treatment. In that case, the early history of the parent plants ought to be known when selecting nuts for seed, for it is obviously an advantage to have trees which bear nuts from their first flowers.

It is probable that the proportion of male to female flowers is higher at Peradeniya than in the low country. There is a theory, which appears to be supported by some evidence, that in cases where a plant bears two kinds of flowers, male and female, on the same or different individuals, those which grow near the upper limit of the species are male. On that supposition, coconuts at Peradeniya would bear fewer female flowers than those in the low country. It may be noted, as an illustration or a coincidence, that the only double coconut in flower at Peradeniya is a male plant, while that in flower at Henaratgoda is a female.

THE INTERVAL BETWEEN SUCCESSIVE INFLORESCENCES.

Systematic observations on this Peradeniya tree were begun on October 20th, 1912, when the inflorescence designated A opened. At that date there was a previous inflorescence still in the male stage, and others, still earlier, bearing young nuts. The following table gives the dates on which subsequent inflorescences opened :—

		Date of opening.	Interval in days.	Rainfall.	
1912	A	October 20th		October	10·37
			43	November	9·56
	B	December 2nd		December	14·84
			44	January	22·29
1913	C	January 15th		February	0·91
			58	March	3·99
	D	March 14th		April	9·26
			49	May	4·43
	E	May 2nd		June	7·21
			24	July	5·54
	F	May 26th		August	5·20
			36	September	2·22
	G	July 1st		October	32·03
			45		
	H	August 15th			
			31		
	I	September 15th			
			49		
	K	November 3rd			

As already stated, "overlapping" occurred only in October 1912, May 1913, and September 1913. Evidently an interval between successive inflorescences not exceeding about thirty days is necessary to ensure overlapping. That requires the production of twelve, or more, inflorescences per annum, whereas on the tree under notice there were only nine.

The interval between successive inflorescences varied from 24 to 58 days. On the average, the intervals at the beginning of the year were longer

than those later. From October 1912 to April 1913 four inflorescences were produced, while during May to September 1913, there were five. The longest interval occurred in the driest months, though it is evident that, in general, the intervals are not governed only by the rainfall. May, the month of the shortest interval, is usually hot and moist at Peradeniya.

THE FALL OF IMMATURE NUTS.

The following table summarises the history of each inflorescence, the numbers representing the duration in days of each stage, except where stated otherwise: —

	Date of Opening.	Male phase.	Interval.	Female phase.	Number of female flowers.	Nut fall begins.	Nut fall continues.	Nuts remaining.
A	Oct. 20th	28	2	5	10	30	39	1
B	Dec. 2nd	35	4	1	1	—	—	1
C	Jan. 15th	29	4	3	4	33	14	1
D	Mar. 14th	27	4	2	3	50	?	1
E	May 2nd	24	4	7	10	46+	?	2
F	May 26th	28	3	5	10	21	26	2
G	July 1st	26	4	6	11	28	9	2
H	Aug. 15th	29	5	6	12	37	unfinished	
I	Sept. 15th	30	4	5	13	25	..	..

This table is to be read as follows: Inflorescence A broke out on October 20th, and for 28 days all the flowers which opened were male. After the last male had fallen, two days elapsed before the female flowers opened. The female flowers were ten in number, and these opened in succession over a period of 5 days. The immature nuts began to fall 30 days afterwards and they continued to fall at intervals for 39 days, when only one was left. Thus 104 days elapsed before this inflorescence had "settled down" to its final condition.

The duration of the male phase varied from 24 to 35 days, the interval between the male and female phase, from two to five days, and the female phase from 1 to 7 days. The number of female flowers on an inflorescence varied from 1 to 13. The small number of female flowers in December, January, and March is especially noticeable, but it has of course to be remembered that these numbers were established long before the flowers opened and cannot be accounted for by any data now available. On two other older trees, the inflorescences produced in December did not bear any female flowers.

The figures referring to the fall of immature nuts show one or two interesting points. One is the long period between the end of the female phase and the fall of the first immature nut. In inflorescence F, this was only three weeks, but in the case of D, it was seven weeks. This does not appear

to bear any relation to the number of female flowers. The nuts continue to fall for periods which again show little regularity. In the case of inflorescence A, 9 nuts fell in 39 days, but in G, 9 nuts fell in 9 days. The nuts from A fell chiefly in January, which was an extremely wet month, while those of G fell in September during a dry period.

The facts at present available are insufficient to afford any explanation of this shedding of immature nuts. It is difficult to determine whether they have been fertilised or not, because by the time they fall, the tissues at the base of the nut and along the central canal have undergone considerable decay. Some indirect evidence on this point might be obtained by artificially pollinating all the female flowers of an inflorescence, or by bagging an inflorescence after the fall of the male flowers and determining whether the unfertilised nuts fell sooner than usual. It is probable that in the case of this tree, in which the number of nuts was always reduced to one or two, some of the female flowers were not pollinated, as it stands in a somewhat isolated position. But against that is the fact that "overlapping" of the inflorescences was not followed by an increase in the number of nuts retained.

In the case of inflorescence A, two female flowers fell before they opened. It was found that that was due to the attack of some insect at the base of the flower, the marks of insect injuries being clearly visible between the floral leaves. That however has not been observed again, and it would appear to be a rare occurrence.

T. PETCH.

COCONUTS IN TOBAGO.

THOS. THORNTON, A.R.C.S.

(*Continued from p. 383.*)

CONCLUSIONS.

From the foregoing remarks it will be seen that good coconut soils must be well drained, and the deeper and looser the condition of the soil the better the plants will thrive, although they are excellent fields on but a moderate depth of soil overlying coral.

Shallow soils overlying clay should be avoided as also should shallow soils on hillsides overlying rotten rock.

It is beginning to be realised amongst planters that to obtain the best results nothing should be neglected which tends to influence the health of the plants. The best seed nuts only should be planted, unfavourable situations should be avoided, good soil chosen, water-logged soils kept clear of, and diseased trees destroyed as soon as found, before they have an opportunity of infecting others. It is being realised more and more that it is much easier to keep a plantation in a healthy condition by attending to the laws of plant sanitation than it is to bring a neglected and diseased plantation back into a healthy condition.

PICKING NUTS.

As the nuts ripen they change first to a yellowish green colour and then to a brown. The brown nut is thoroughly ripe and if not picked will fall to the ground. The nuts on one flowering branch do not all become brown at the same time, but when some of them have changed colour, it is generally considered that all the nuts on that branch can be picked. At one picking single trees will give from twenty to forty nuts.

The nuts are picked by natives who climb the trunk, holding it with both hands and stepping from one leaf scar to another. As they are paid according to the number they pick, they have to be watched, otherwise will pick green nuts. The price paid for picking varies between 80 cents and $1 per 1,000 nuts. A good picker can gather as many as a thousand a day, but many of them will not pick more then about 400.

The nuts are picked three times a year, that is every four months.

RETURNS.

The returns vary considerably according to the age of the tree, the character of the soil and the attention given to them. Four thousand nuts per annum per acre are obtained on some places in Tobago, but there are other places where the trees are old producing only about half that amount.

PREPARING FOR MARKET.

Before the nuts can be shipped the husks have to be separated. In Tobago this is done by means of the hoe. It is laid on the ground with one corner of the blade standing upright; this is forced in the husk at about three places near the end where it was attached to the stalk and the husk is prised off. The price paid for husking is 60 cents per 1,000.

MATURING PICKED NUTS IN SHEDS.

Some planters are now placing their nuts in large sheds covered with coconut leaves to allow those not thoroughly ripe to mature. The nuts are carted into the shed as they are picked, and allowed to remain there for one or two months in the cool before they are husked. The opinion is that those not thoroughly ripe mature when thus stored. Results have been satisfactory, as fewer have been rejected by the merchant's selector when they have been stored in the cool sheds.

DISPOSAL OF CROPS.

The Tobago coconut crop is all disposed of to Trinidad merchants, either simply as nuts or manufactured into copra. Contracts are made with the merchants for the year's crop, or the planter sells his nuts taking his chance of the market at the time the nuts are shipped. The nuts are selected on the estate into two classes, "selects" and "culls."

SELECTS AND CULLS.

The difference between the two classes is a question of size; they are measured by means of a ring with an internal diameter of $3\frac{3}{4}$ inches. Those too large to pass through the ring are "selects" and the nuts which pass through are "culls."

Occasionally very small nuts are found; these are called "egg nuts," and are classed by the merchants as "rejects."

COPRA.

Often the nuts are manufactured into copra before being sold. This is merely the dried kernel of the nut. In Tobago it is usually dried in the sun on large trays, but on one or two places it is also dried in chambers with hot air. With good weather sun-dried copra can be made in five or six days, and in hot air chambers in about ten hours.

A ton of copra can be obtained from six to seven thousand nuts according to size. When the nuts are exceptionally small more may be taken.

SHIPPING.

The copra is mostly shipped to Trinidad by the R. M. Steamer, which is under contract to come to Tobago three times per fortnight. Each week it goes once round the island and takes up cargo at the various depôts. One trip each fortnight it only comes to Scarborough, the chief town. There are also certain sloops which take a part of the cargo.

DISEASE.

As regards coconut diseases the two principal ones are bud-rot and root disease. It is expected that the island will suffer little from bud-rot now that an ordinance has been passed by the Government that any coconut palm suffering from this disease shall be cut down and destroyed, and inspectors have been appointed to enforce it.

The root disease is not understood but it is being investigated by the officers of the Department of Agriculture and the Board of Agriculture and everything that can will be done to stamp it out.—Bull. No. 71, Agric. Dept. of Trinidad and Tobago.

WHITE ANTS ON COCONUTS.

To The Editor of the Tropical Agriculturist.

Sir,

I have just planted an estate full of coconut plants. I regret to say that I lost a fairly good number on account of the ravages of white ants. Even sea sand and lime do not seem to prevent them from attacking the plants. Messrs. Freudenberg & Co. wrote to me to say that Ceylon planters use one pound of Kainit and one pound of lime when they plant the seedling and they advised me to follow their example. I cannot get Kainit here and the cost of getting the same down prevents me from using the same.

Will you or any other experienced Ceylon coconut planter let me know whether the application of tar diluted with kerosene oil on the husk of the coconut of the seedling will prevent the seedling from the ravages of white ants. Will such an application prove injurious to the seedling?

Will any of the Ceylon planters be good enough as to let me know through your valuable journal as to how they plant the seedlings on the sides and slopes of a hill. It is the custom here to level the sides of the hill to the level of the foot of the hill and plant the coconut seedlings, because it is believed that coconuts do not thrive on the slopes and sides of a hill. Is this belief correct?

When the plants are about to spread out their leaves, a kind of a blue beetle attacks the plants and eat away the fresh shoots. What is the best remedy for this?

Yours faithfully,

P. KRISHNASWAMI ROW.

Nedungoleru Estate, Quilon, 10th November, 1913.

COCONUTS IN FIJI.

By H. H. THIELE.

(*Contd. from p. 373.*)

INSECTS ATTACKING COCONUTS.

Of these there are several kinds ; but as some of them do comparatively little damage as yet, I shall limit myself to dealing with the most important three. In the July number of this journal (Fiji Planters' Journal) appeared a report by the HON. C. H. KNOWLES, describing a leaf disease on Vanua Levu, which is also met with on Taviuni and I believe on others of these islands. It will be unnecessary for me to repeat his report here.

The Viti Levu leaf disease has done damage to such an extent that planting and cultivating the coconut palm was practically given up many years ago on this island. Fortunately it has not as yet spread to any other parts of the group. There are a good many trees scattered about on Viti Levu, but they have hitherto borne a sickly appearance, producing only a few nuts and, in many instances, none at all.

It has been established that the disease is due to a small moth not hitherto found anywhere else, of which MR. KNOWLES (in 1911) sent specimens to MR. BETHUME-BAKER, by whom they were placed in the new genus Levuana and named L. iridescens, B. B.

MR. F. P. JEPSON (Government Entomologist) in his report on Economic Entomology (1911) writes as follows :—

"Every effort has been made to trace the early history of this pest in Fiji. Planters of long standing in the Colony have been consulted, but little help has been obtained from them beyond the fact that the trees are now worse than they used to be. As these insects have increased unchecked for years, one can readily accept this statement. It was thought that much help might be obtained from the natives, but, as is well known, the Fijians have little idea of the passage and reckoning of time. The oldest native inhabitants speak of this disease of coconuts as occurring as far back as they can remember, and there are several native superstitions which regard it as a curse for the misdoings of their ancestors in early times."

As long ago as 1877 MR. J. HORNE, who, at the invitation of SIR ARTHUR GORDON, visited these islands with the object of inquiring into the botanical, agricultural and economical resources of the Colony, makes references to this insect in his useful little book entitled "A year in Fiji." MR. HORNE says : The subject ought to be investigated, in order that a remedy may be found and applied ; and if this is done, the coconut tree could be increased a thousand-fold in the Colony."

A period of nearly thirty years elapsed before any steps were taken to carry out MR. HORNE'S suggestion. As a consequence this moth has continued its ravages, and has multiplied unchecked, and the localities from which it has been reported in Viti Levu show that its distribution is universal throughout the island. In January, 1909, MR. KNOWLES, in his report on coconut pests to the Colonial Secretary referring to this moth stated : In my opinion the effects of this insect are chiefly responsible for the unproductiveness of coconuts on this island.

It is believed that Taviuni is free from this pest at present, and it has not been observed by the writer in any part of Vanua Levu which he has visited.

The distribution of this insect has been by no means an easy matter to ascertain, owing to the fact that following a period of activity of a few months there is a quiescent period of several months when no trace of the moth is to be seen. Their disappearance still remains a complex puzzle, as diligent searches for the eggs at these stages in the life-history of the moth might be spent in the egg state, but careful searches for these among the debris and fibre around the trunks of palms were unsuccessful. It was again thought that possibly the moths of certain generations might at this time of the year migrate to another host plant for a time, and after having there completed a series of generations, return to the coconut. This moth has, however, never been observed on anything but the coconut palm and the Royal palm (Oreodoya regia) and of the latter there are a very limited number in Fiji.

New comers to Viti Levu are at once struck by the unhealthy appearance of the coconut palms on this island. The lower leaves lack the rich green colour which one usually associates with coconut palm, and are instead a dirty brown colour, and in many cases resemble dead leaves. Upon closer examination it will be observed that there are numerous transparent lines running parallel to one another in a longitudinal direction from the base to the apex of each leaflet. In many instances the leaflets consist merely of a fine network surrounding the midrib. These transparent lines are caused by the removal of the epidermic cells on the under surface of the leaflets. As has been stated above, the larvæ upon hatching from the eggs, which have been deposited upon the undersurface, commence to feed, and travelling in a straight line parallel to the midrib, remove a layer of epidermal tissue in their progress."

Strange to say from the latter end of last year a change commenced to take place in the appearance of the coconuts in most parts of Viti Levu. Many of the hitherto sickly looking trees began to put out more and quite healthy looking leaves, some palms which formerly bore but few nuts are showing more, and others (some of them more than twenty years old) which never set fruit before are now producing nuts.

The chance of combating the pest successfully seems to me now considerably increased. There has not as yet been sufficient time to investigate the cause of the improved conditions, but it is most likely that some natural enemy which has hitherto escaped notice to such an extent as to become an effectual check to the pest. There may, of course, be other reasons, but whatever these are it must be borne in mind that as the disease has existed and spread during a great number of years without any, or very little, hindrance, the change must be due to something hitherto unknown which has appeared on the scene and made its presence felt. It cannot be the effect of abnormal weather conditions as these have been much as usual during the last twelve months, nor can it be due to any hurricane, as such have occurred before without showing any special beneficial effect on the palms left standing.

BUD ROT.

This disease is found nearly everywhere where the coconut palm is growing. It appears to have been noticed in Cuba some forty years ago but it has only lately been described in the WEST INDIAN BULLETIN, Vol. VI., where it is stated that bud-rot had caused heavy losses. It was also found in East Africa, Ceylon and the Federated Malay States, but no particular notice was taken of it as it did not appear to do much damage. In Southern India it has attacked the Palmyra palms in particular, and in 1905 it is supposed to have spread over 900 square miles.

The first sign of the disease—as far as I have observed—is the drooping of the youngest unfolded leaves; these wither and fall off and are in course of time followed by the other leaves. The trees I saw attacked in Taviuni were all young and not bearing any nuts. It is of course difficult on a large plantation to examine every tree often and regularly especially if they have not been planted in rows. The disease develops very rapidly, and I have great doubt as to it being possible to arrest its progress and save the tree after the top leaves have indicated its presence. All the trees I found suffering from the disease were at once felled, the tops lopped off, dry leaves piled on top of them and set fire to.

MR. T. PETCH (Government Mycologist, Ceylon), writes as follows:—"A case was brought to the notice of the Department early in 1906. The specimen submitted consisted of the upper part of the stem, capped by a dark brown, soft, foul-smelling mass, which represented the 'cabbage.' Its close resemblance to the West Indian 'bud-rot' was very evident, and a visit to the affected locality confirmed the supposition that we had to deal with the same disease.

"The affected property is a small isolated patch of ten acres, carrying about 800 palms, of which about fifty are dead or dying. The trees attacked are three to four years old; those in bearing do not show any signs of the disease at present.

"The first indication of the disease (in the case of young plants) is the withering of the youngest unfolded leaf. This turns brown and can be pulled out of its sheath; it is then found to end in a soft brown mass identical with that described above. The decay of this leaf is followed by the death of the other fronds in succession, commencing with the youngest and proceeding outwards and downwards. The fronds decay and fall off until only a conical stump remains. If the dying fronds are removed and the bud exposed there will be found, instead of the white cabbage, a pale, semi-liquid mass, which becomes dark-brown with age and possesses an odour resembling that of a tan yard. In an advanced stage this rot includes the whole of the cabbage, and stops only when the woody portion of the stem is reached. Only the soft parts are affected. The roots and stem are quite healthy, but the destruction of the terminal bud necessarily causes the death of the tree. The time required for the complete destruction of the tree is given as from one to three months.

"The nature of the disease and mode of growth of palms make it impossible to find a remedy for trees already infected, and leaves for

consideration only the methods for preventing its spread. Diseased trees should be felled and the terminal bud burned. It should not be allowed to lie on the ground and become dry."

Dr. Edwin Smith (United States Department of Agriculture) writes from Cuba as follows :—

"The disease (bud-rot) has made decided advances since it was studied by Mr. Busck in 1911, especially at Mata, and if it continues to spread as it has done during the first ten years, it will inevitably destroy the coconut industry of the island, and that, too, within the next ten or fifteen years. Already many of the planters are discouraged and not setting any more trees, since it now attacks trees of all ages, including quite young ones, and those on the hills as well as those close to the sea. The disease is frequently known as 'the fever' and often one sees where the bases of the trunks have been scorched with an idea of preventing the development of the disease. The disease is not lodged in the roots, however, nor in the stem. These in all cases appear to be sound. The general symptoms are the yellowing and fall of the outer leaves, the shedding of the nuts, and some months later the death of the whole crown. The cause of this decline is not apparent until the tree is felled and the crown of leaves removed, including the wrapping of the strong terminal bud. The latter is then found to be the seat of the disease. This bud with its wrappings of young and tender leaves is found to be involved in the vilest sort of a bacterial soft rot, not unlike that of a decaying cabbage or potato, but smelling much worse, the stench resembling that of a slaughter house. This rot, invisible until the numerous outer leaf-base wrappings are removed, often involves a diameter of several inches of soft tissues and a length of three or four feet, including flower buds and the whole of some of the soft fleshy white undeveloped leaves covering the bud and forming the so-called 'cabbage' of the palm stem immediately under the bud and does not attack any of the developed leaves. It is a disease of the undeveloped tissues. When the tree is felled and opened up, carrion flies and vultures are promptly attracted by the horrible smell. Fly larvæ and various fungi were found in the parts most exposed to the air and longest diseased, but the advancing margin of the decay was occupied only by bacteria of which there appeared to be several sorts.

"The picture of one diseased tree will answer for many. No fungi or insect injuries were found which could in the least account for the death of the tree. The disease is the result of bacterial rot of the terminal bud and its wrappings, including the flower buds. The bacteria probably find their entrance through wounds of some sort, and their distribution is undoubtedly favoured by carrion creatures. The larva found deepest down in the rotting tissues was that of the common scavenger fly (Hermetia illucens).

"Occasionally the crown of the tree was found yellow from other causes but if the youngest visible leaf (projecting five or six feet) was observed to be looped over and wilting or shrivelled, the soft rot was sure to be found on cutting down the tree and removing the close-wrapped leaf bases. Diseased trees should be felled and the terminal bud burned or properly disinfected with sulphate of copper."

Mr. F. P. Jepson in his report on Economic Entomology (Fiji) writes as follows on a "cabbage" eating moth (Trachycentra sp.) :

"On two plantations at Taviuni it was noticed that there were small clumps of trees which had lost their heads, and only the bare trunks remained. Some of the planters attribute this to the effects of lightning. Upon examination of the fallen heads, large number of larvæ and pupal cases were found as many as one hundred being taken from a single 'cabbage.' The tracks of these larvæ were discernible down to the hard part of the trunk, where they ceased. The whole cabbage was reduced to a fœtid, offensive-smelling mass, and was in a very advanced state of decomposition. Where the eggs of this moth are laid is not known at present, but probably it will be found to be on the leaf bases where small larvæ have been discovered making their way towards the cabbage. The condition to which these palms are reduced appears to very closely resemble the 'bud-rot' disease which occurs in the West Indies, etc"

The inference which appears to me the most natural to draw from the foregoing reports is : that bud-rot is caused by the piercing of the young and tender leaves surrounding the cabbage. Once an opening is made the soft and sweet interior is immediately attacked by bacterii, fungi and sundry insects.

Mr. Jepson is probably right in supposing the Trachycentra does the initial damage with us ; but as this moth has not been mentioned (as far as I know) by writers in other coconut growing countries in connection with the disease, it is most likely that there is something else—animal, bird or insect—which is to blame. Whatever causes the wound, the result is bud rot.

Although palms killed by bud-rot if left standing have ultimately very much the same appearance as those struck by lightning there is very considerable difference in the two operations.

Lightning will as a rule shatter one or two trees badly and those standing close by will be damaged by the heat to such an extent that they get diseased, their tops rot and they die, their stem being marked with a number of brown spots.

Now with bud-rot my experience has been to the effect that a healthy tree standing next to a diseased one does not get it. At the plantation I was on at Taviuni the area on which trees became attacked was limited to some six acres. Here a palm showing the disease would be felled ; the next one attacked—probably many months later—would be found at the other end of the block, then perhaps some tree in the middle would suffer, but I never saw two diseased trees standing together, there were always some five or six, and generally more, healthy ones between them. The stems of the trees felled never showed the spots found on those killed by lightning.—Fiji Planters' Journal.

THE ENEMIES OF THE COCONUT.

In view of the following reference (in the PHILIPPINE AGRICULTURAL REVIEW) to the troubles connected with coconut cultivation, local planters might well congratulate themselves on the comparative immunity they enjoy:—

"Cuba is rapidly losing her coconut industry, some localities having already lost about 75 per cent. of their trees from bud-rot. Nearly all countries are greatly troubled by the rat pest. All the Orient is suffering from the red weevil and the black beetle, although in the Philippines there is comparatively very little damage done by either of these two insects. In Malaya, India, and the East Indies, a fungus disease known as the "stem-bleeding fungus" (*Thielaviopsis ethaceticus*) is causing considerable damage but does not appear to be present, thus far, in the Philippines.

A root disease, supposed to be caused by a *Botryodiplodia*, affects about one-fifth of the North Travancore district in India, where about 100,000 hectares are in coconuts, and in this area the percentage of attacked palms runs from 5 to 75 per cent. A very serious root disease, as well as "bud-rot," also occurs in Trinidad, British West Indies."

MAHA-ILUPPALAMA COCONUTS.

A seventh round of picking was completed on September 30th. The number of nuts collected was 396 from 80 trees which gives an average of 5 nuts per tree (or 3·5 nuts per bunch picked).

Of this quantity

In the cultivated area, trees 5½ to 6 years old:—76 trees gave 386 nuts, an average of 5 nuts per tree (or 3·5 nuts per bunch picked).

In the uncultivated area, trees 6½ to 7 years old:—4 trees gave 10 nuts, an average of 2·5 nuts per tree (or 2 nuts per bunch picked).

The following figures have been obtained with regard to copra production:—

Picking.	Break.	Rejections.	Copra lb	No. of nuts required per candy.
July	474 nuts	2%	227	1147
August	242 nuts	2%	112	1185

General notes:—The whole of the area under coconuts is in a state of thorough cultivation. With the advent of the N.E. rains, all cultivation will have to be suspended until the cessation of the rains in January.

All drains are in good order.

Work in connection with the preparation of 25 acres of land for coconut planting is still proceeding. Planting will take place in January.

G. HARBORD,
Manager, Expt: Station.

PERADENIYA EXPERIMENT STATION.

COCONUTS.

A good sample of copra has been obtained by carefully washing out the nuts after breaking and drying in the sun. It was reported on in Colombo as first grade and would command top-price. Good clear oil was also obtained from this copra.

D. S. CORLETT,
Manager.

THE DIESEL ENGINE.

WHAT IT MAY MEAN FOR TROPICAL AGRICULTURE.

The following extract from an article in the SCIENTIFIC AMERICAN on the late MR. RUDOLPH DIESEL gives some idea of the important part vegetable oils are likely to play in marine propulsion in future.

The intimate admixture of the pulverized liquid fuel, into the midst of highly compressed air much above the temperature of ignition, also insures complete combustion, even when heavy and ordinary difficult fuels are used, so that all liquid fuels may be used indifferently, from the light gasoline to the heavy distillate residues. Gas tar is readily and fully consumed, and vegetable oils, such as peanut oil or castor oil, are freely converted into power in the Diesel engine. The revolution which such a machine is creating in the development of power must appear. In nearly all the countries of the civilized world the Diesel Engine is being manufactured, and the leading constructors of Germany, France, Switzerland, Russia and Sweden, as well as England and America, are interested in this modern power machine. It propels practically all the effective submarine vessels in service, it is entering into the merchant marine, and unless the ship on the water is superseded by the ship in the air, it must enter the naval service of all progressive powers.

IRON AS A PLANT FOOD.

Iron though an indispensable element of plant food (and considered necesssary for chlorophyll formation) is absorbed in very minute quantities. Some plants, however, appear to be unable to take in iron from the soil and hence suffer from what is known as chlorosis, which is characterised by a yellow colour of the foliage. It has been suggested by VANDBEL that the form in which iron is taken up by the plant is as a compound with ammonium nitrate. In view of the fact that iron has been found efficacious in the treatment of such diseases as silver leaf disease, the possibility of its being supplied in a readily available form is of the utmost practical importance. THE GARDENERS' CHRONICLE of November 1913 (from which this abstract is made) recommends the trial of this compound of iron and ammonium nitrate in maintaining a healthy condition in plants.

PADDY.

CULTIVATION IN CEYLON DURING THE XIXTH CENTURY.

BY E. ELLIOTT.

(Continued from p. 394.)

SUMMARY.

As this compilation has run to such a length and been published in parts it is desirable I think to summarize the facts and figures set out, and the conclusions arrived at which are as follows:

(1) That the returns of paddy cultivation published annually in the Ceylon Government Blue Books, from 1862 onwards are not, as has been alleged, utterly unreliable but when corrected for printers' and other obvious errors, sufficiently accurate for purposes of comparison, though the figures for production are probably 25% too low.

(2) That the adverse criticisms passed on these returns are largely due to disregard of the concurrent climatic conditions by which such variations are really caused—while other unfavourable opinions have been based on comparisons of single years* and without regard to the rainfall of the Agricultural year. This in Ceylon is practically identical with the Singhalese year which covers the climatic conditions governing the growth of the two crops Maha and Yala, sown in different but harvested in the same *Calendar* year.

(3) That to avoid these errors, the statistics relied on in this memoir have been compiled from the Blue Book returns since 1862 *duly corrected* and the opinions expressed or arrived at by comparisons of periods of five years and due consideration of the concurrent rainfall and its distribution.

(4) That owing to the extent cultivated with paddy a second time within the year (especially in the Central Province) not being always included in the returns of acreage, the progress made must be preferentially judged by the amount of the crops produced, rather than by the reported area sown.

(5) That the abolition of forced labour (Rajakariya) in 1832 (September) led to the general neglect of the irrigation works, great and small, and was accompanied by the desuetude of the old customs of communal co-operation in the cultivation of paddy. Consequently the annual production fell to certainly $5\frac{1}{2}$ millions, if not less, in the 10 years ending with 1856.

(6) That the passing of the first paddy cultivation ordinance of 1857, which provided for the voluntary restoration of the old system, led to a steady advance in production which amounted to an average of a million bushels, in the period 1866-71.

* "In England the yearly average of wheat production has varied from 84 to 101%, taking 100 as representing perfect healthfulness, but the *10 years' average* has only fluctuated between 92 and 93%." (London Times Review of British Crops.)

(7) That during the 15 years between 1878 and 1892, the climatic conditions were very favourable in most parts of the island, the rainfall in the Agricultural year (ending in April) averaging 96 inches. In addition, the irrigation works initiated by SIR HERCULES ROBINSON also had a beneficial influence. Under these favourable circumstances there was a general addition to the area cultivated, and a rise in the annual production of about a million bushels, until ten millions off 613,000 acres was reached in 1892, the year the so-called Grain Tax was abolished. Of this increase of $3\frac{1}{2}$ millions, the non-irrigated districts contributed $2\frac{1}{4}$ and the irrigated $1\frac{1}{4}$ M. B. P. (million bushels paddy).

(8) That though the rainfall of the next two periods (1893-1902) averaged somewhat less, viz., 85 inches, the increase of a million bushels per year was maintained, production rising to 10·7 and $11\frac{3}{4}$ M. B. P. and the area cultivated to 589,000 and 663,000 acres respectively.

(9) That the next period opened with a year of heavy rainfall 114 in. and the biggest crop ever known in Ceylon, over $13\frac{1}{2}$ M B. P. off 713,000 acres was secured in 1903. Further the average of the years 1903-07 reached the very satisfactory figure of 12·3 M. B. P. notwithstanding two years (1906 and 1907) of short rainfall ($67\frac{1}{2}$ inches) and the cyclone in the latter year which had such disastrous effects in the Batticaloa district.

(11) That of this further increase of 3 M. B. P. between 1892 and 1907, the irrigated districts* contributed 2·4 and the other districts only 600,000 bushels of which two-thirds were supplied by the Kegalle district, where climatic conditions are very favourable and an increase of 8,000 acres in the area cultivated is recorded as having occurred in this interval of 15 years.

(12) That of the 700,000 acres of paddy land actually cultivated in the island, about 360,000 lie in what may be termed the irrigated districts; but 60,000 of this area is dependent on the district rainfall, and of the balance half is under village tanks in the North-Western and North-Central Provinces

(13) That the total paddy land in the non-irrigated districts is about 340,000 acres, dependent on the direct rainfall and it is probable all the land suitable for paddy (except in the Northern Province) has been *asweddumized*, especially in the Colombo, Kegalle, Kandy, Kaltura and Galle districts, and no great addition can in these districts be expected. But the returns of the areas sown disclose no reduction showing the fluctuations in production are due to the rainfall.

(14) That in 1906 began the dry cycle of years, which has had an adverse effect on Coconuts as well as paddy, and during the four years (1908-11) the average rainfall (registered at Colombo) was only 64 inches. The average production for the period has been consequently reduced somewhat, having been 10·9 M.B.P. of 660,000 acres or a reduction of 4% in area and 9% in production as against 20% less rainfall as compared with corresponding figures for the previous period (1903-7). The shortage was almost

* This includes the Eastern and N. C. Provinces, and the districts of Badulla Matara, Hambantota, Sabaragamuwa and Kurunegala, where there has been considerable outlay on irrigation in modern times.

entirely in the Irrigated districts where the cultivation is largely dependent on an ample and well distributed North-East monsoon. But in the non-irrigated districts where the South-East is the more important factor, there was an actual increase of 6,000 acres in the area cultivated and a deficit of only about 130,000 in a crop of over 4 M.B.P. This fact is of importance as negativing recent suggestions that the cultivation of paddy is being abandoned in these districts.

(13) That the entire advance during the 50 years ending with 1907 was as follows:

Average	Area Cultivated		production.
1903-7	687,000 acres	...	... 12·8 M.B.P.
1851-6	401,000 „	...	... 5·7 M.B.P.
Actual Increase	286,000 ...	...	... 6·6 M.B.P.
% of Increase	71 ...	...	... 115
In The Irrigated districts...		...	... 3·7 M.B.P.=64 p.c.
.. Non-Irrigated districts...		...	... 2·9 „ „ =51 p.c.

GASES OF PADDY SOILS.

An interesting number of the MEMOIRS OF THE DEPARTMENT OF AGRICULTURE IN INDIA is that entitled "The Gases of Swamp Rice Soils and their Relation to the Crop" by the Government Agricultural Chemist, Madras, and his assistant. We take the following extracts from it:—

INTRODUCTORY.

Irrigated paddy or rice in South India is generally grown under swamp conditions throughout the growing season and in a puddled soil, i.e., ploughed or levelled in water, but no general system of cultivation holds good, nor can it be said that what is found to be successful in one place will answer in another. On the South Malabar Coast, it is the general practice to plough the lands in the dry season with excellent results, but this same custom introduced into other districts has led to failure. Paddies which flourish in one delta or district often do not do so well when transferred to another place where the conditions are apparently of a similar character. Green manuring is found to answer perfectly well in one area, but when tried in another area the crop fails. In one district the water may be run on to fields and the latter puddled and manured weeks before the crop is planted, but in other districts the custom is to put in the green manure just before the time of transplanting. These and the many other mutually opposed facts which can be quoted, make it essential that the conditions governing the growth of paddy should be closely studied in order to obtain, if possible, some common basis capable of explaining that material improvement can be made in paddy cultivation.

On considering the problem in all its general aspects, it was felt that a study of the soil gases formed the most promising field of enquiry, and the results obtained, as well as some from closely connected investigations, are detailed in the following pages.

Before proceeding to a consideration of the investigation, a brief description of the cultural conditions of Swamp Paddy Soils in South India will make clear the peculiar conditions under which the crop is grown and also clearly demark the scope of the enquiry and the application of the results.

In general, these soils are allowed to lie in an uncultivated condition during the hot season, during which period they dry to a considerable extent and, owing to their very heavy character, shrink considerably and wide cracks are formed reaching down to a depth of from two to three feet. This deep cracking of the soil leads to complete aeration, and no doubt nitrification proceeds apace at this time. On the South Malabar Coast, however, the land is systematically worked over during the dry season. As soon as water is available seed-beds are formed where the paddy germinates and grows until the time of transplanting arrives. Some time before transplanting water is admitted to the fields, which are then thoroughly ploughed and puddled, and the heavy crop of weeds formed on the dry soil is worked in. In addition, wherever available, large quantities of green-leaf manure are thoroughly incorporated with the soil by the trampling of cattle or coolies.

The amount of green manure used varies its availability and cost, but often the cultivators will scour the dry land for miles around to obtain it, and the use of as much as 4,000-5,000 lb. per acre is quite common. In the deltas green-leaf manure is very scarce, and its use is not so common, but even there the seed-beds are heavily manured. In the Kistna Delta it is a common practice to sow sunhemp (Crotolaria juncea) just before harvesting the paddy and the resultant crop is used as fodder, but the straw and roots are ploughed into the soil.

After puddling and manuring the surplus water is allowed to drain off and the seedlings are transplanted. After transplanting, wherever the conditions permit, water is not allowed to stand in the fields until the seedlings are established, but care is taken to keep the moisture conditions such that no cracking or shrinking of the soil takes place. When the seedlings are established water is admitted in quantity and the whole of the fields are kept under water throughout the rest of the growing season, but, if possible, the land is drained just before harvest to permit of the drying off of the crop.

The main features, then, of paddy cultivation in Southern India are: (1) the maintenance of swamp conditions by the use of large quantities of water and by puddling the soil and so decreasing the naturul drainage ; (2) the use of large quantities of green-manures. It is obvious that under these circumstances the soil conditions must be quite dissimilar to those obtaining in dry soils and that the course of the decomposition of the manure and the nutrition of the plant must also be very different.

THE VARIATION IN THE COMPOSITION OF THE SOIL GASES.

On forcing a stick into the soil of paddy fields or on disturbing it in any other manner, bubbles of gas are given off which are easily collected and which on analyses are invariably found to consist mainly of Methane and

Nitrogen. The proportion these gases bear to one another varies greatly, the Methane from about 15 to 75 per cent. of the total and the Nitrogen from about 10 to 95 per cent. In addition, Carbon-dioxide is generally present together with small amounts of Oxygen and Hydrogen. Other gases were tested for at intervals, but only those mentioned above have been detected. The amount of Carbon-dioxide present is, on the average, about 5 per cent. but this value may fall as low as 1 per cent. and rise as high as 20 per cent. The amount of Oxygen is usually only a trace, but values as high as 5 per cent. have occasionally been met with. Hydrogen is generally absent but as much as 10 per cent. has been recorded.

SUMMARY.

The conclusions arrived at may be summarized as follows :—

(1) The normal fermentation of green manure in swamp paddy soils leads to the production of a relatively large proportion of Methane, a smaller amount of Nitrogen, together with some Carbon-dioxide and Hydrogen.

(2) The introduction of a crop so modifies the gas production that the proportion of Methane in the gas is greatly reduced and that of Nitrogen increased. The evolution of Hydrogen is practically inhibited.

(3) The action of the crop is to restrict the formation of Methane and Hydrogen either by retarding the rate of fermentation or by a portion of the intermediate products of decomposition being absorbed by the roots. There is also evidence adduced to show the normal evolution of Nitrogen is retarded in a similar manner.

(4) The soil conditions are shown to be anærobic in character immediately after water is admitted to the fields, and these conditions persist so long as irrigation proceeds. Under these circumstances nitrification is impossible and the Nitrates produced during the dry season are quickly denitrified so that the Nitrogen required by the crop is obtained from the Ammonia and nitrogenous organic compounds produced by the anærobic decomposition of the proteids of the green manure.

(5) Certain of the substances produced by this decomposition are toxic to the crop, and must be removed in the drainage water, or destroyed by prolonged decomposition before the seedlings are transplanted, otherwise the crop will suffer. The application of green manure to badly drained areas must, therefore, be undertaken with circumspection and caution.

THE GASES EVOLVED FROM THE SURFACE OF PADDY SOILS.

In the foregoing section of this Memoir attention has been called to the fact that the gases present in the soil itself are dissimilar in composition from the gases which are evolved from the surface of swamp paddy soils. The latter consists mainly of Oxygen and Nitrogen, and we have not been able to detect the presence of Methane, Hydrogen and Carbon-dioxide in them. The last mentioned gases are characteristic constituents of the soil gases and as a consequence there did not appear to be any connection between the soil gases and the surface gases. That there was some relationship, however, between the rate of evolution of Oxygen and the presence or absence of a crop was indicated by a number of hap-hazard determinations made during the year 1909 and consequently, at the earliest opportunity, some pot-culture experiments were instituted to test this point.

SUMMARY. II.

These investigations have led the authors to the conclusion that the surface film of algæ, etc., which covers the surface of swamp paddy soils and which evolves large quantities of Oxygen, is the chief agent in causing the aeration of the roots of the crop.

The Oxygen evolved by this film is dissolved in the irrigation water and thus produces a very highly aerated solution from which the roots derive the Oxygen essential for them. In undrained soils, this solution does not penetrate into the soil, and, consequently, the roots are congested near the surface of the soil and the amount of soil from which they derive their food is therefore limited and the crop suffers. In drained soils this strongly aerated water penetrates the soil and the roots are able to penetrate to a greater depth. The mass of soil from which the food supply is drawn is increased and the crop benefits in proportion.

Too great a rate of drainage decreases the formation of the film and the aeration of the roots is thereby lessened. There is therefore for all swamp paddy soils an optimum rate of drainage which produces the greatest aeration and this rate of drainage is a comparatively slow one.

Aeration of these soils by atmospheric Oxygen is not as effective in promoting root aeration as is aeration by the water draining through them.

The use of green manures in drained paddy soils induces a greater activity on the part of the surface film, thus leading to a better aeration of the roots.

PADDY AT THE GOVERNMENT STATIONS.

PERADENIYA.

The yala or four months paddy has been harvested yielding 72 bushels of paddy and 2,200 bundles of straw or 24 bushels an acre—quite a good crop.

A nursery has been sown with Dr. Lock's improved paddy ready for transplanting in November. The nursery was manured with a mixture of Precipitated Phosphate 38 lb., Fish Guano 38 lb., Sulphate of Ammonia 20 lb. Horn Meal 38 lb. All the plots were flooded leaving a silt.

MAHA-ILUPPALAMA.

Arrangements are being made with neighbouring villagers to cultivate as desired the 9 acre plots this season on the usual terms. An arrangement of this sort is necessary as part of the labour force will shortly be transferred to Anuradhapura.

TOBACCO.

NICOTINE IN TOBACCO.

D. CICERONE & G. MAROCCHI.

The work of D'ERRARA and of DE TONI led to the conclusion that the nicotine in tobacco is located in the epidermal tissue. The writers limited their investigations to the leaves and sought to determine which parts contained the largest quantity of nicotine, using a variety of first-class Kentucky tobacco for the purpose. The leaves were dried by direct heating and analysed after having undergone slight fermentation for 4 months in small heaps.

In the long axis of the leaf, the median zone is always richest and the basal zone poorest, the apical zone being almost equal to the median zone. The marginal zone is always richer than the central zone. In the rib the nicotine content decreases regularly from apex to base and the rib as a whole contains about two-thirds less than the leaf blade.

NICOTINE PER 100 DRY MATTER IN VARIOUS PARTS OF THE BLADE AND OF THE MIDRIB.

Samples from.	Avellino.	Monticchio.	Caserta.	Scafati.	Cava Tirreni.
Blade					
Apical zone ...	7·45	5·07	7·46	7·67	7·00
Median ,, ...	7·71	5·31	7·70	7·94	7·81
Basal ,, ...	7·00	3·97	5·72	7·34	5·80
Marginal ,, ...	7·49	5·62	7·75	8·30	7·64
Central ,, ...	6·52	4·24	6·44	7·00	7·67
Rib					
Apical zone ...	2·85	2·16	2·70	3·16	3·22
Median ,, ...	2·17	1·17	1·52	2·47	2·65
Basal ,, ...	1·74	0·66	1·37	1·47	1·52

MONTHLY BULLETIN.

WHITE ANTS IN ORCHARDS.

White ants are difficult things to deal with in an orchard, as poison that will kill them will also affect living plants. When planting, care should be taken that all damaged roots are cut clean away. As regards deep planting if the scar of the graft is covered with the soil, we often find that white ants attack this spot and gain a foothold on the young tree. Thus deep planting is a mistake if it brings the scar underground.

Care should be taken to remove all stumps and bits of dead wood from ground intended for an orchard, as these tend to harbour the pests. Where the ground is kept well worked round the trees, white ants seldom do any damage. When they are found about the roots of a fruit-tree a few pounds of Kainit dug in will drive them away, and also act as manure.—AGRICULTURAL GAZETTE OF NEW SOUTH WALES.

FIBRES

THE WATER HYACINTH AS A FIBRE PLANT.

The water hyacinth *(Eichornia crassipes)* was introduced into Cambodia about the year 1902, probably from the Philippines or Java. Since then it has spread with extraordinary rapidity and now occurs in such masses on the rivers that navigation is impeded. It has become necessary to take steps to clear the waterways by collecting the plants by means of booms placed diagonally across the stream, and to remove and burn the plants as they accumulate above the boom.

A French professor, PROFESSOR PERROT, has recently communicated to the Saigon Chamber of Commerce his opinion that this dreaded water hyacinth is likely to give rise to a new industry. He states that the plant possesses strong fibres which give every promise of being of great value for textile purposes. He has extracted the fibre from the stalk in a Duchemin machine, and finds that after drying it in the shade it is quite fit for use. Rope and twine have been made from it, as well as coarse thread suitable for matting and sail cloth, while a local use is indicated for it in its employment for the manufacture of rice sacks in place of jute. On the native loom it affords a strong flexible cloth of about the same strength as jute.

The fibre takes dyes readily, and its tenacity is highly satisfactory. Its weight is about the same as that of jute, but can be diminished by treatment with chrome alum; this treatment makes the material waterproof. By PERROT'S process, which can be carried out by native workers, 100 kilogrammes of green stems yield 4·5 kilogrammes of fibre.

If this information proves correct, it will be good news for countries which are cursed with the water hyacinth. It sounds rather too good to be true, at least with the plant as we know it in Ceylon. In any case, it would hardly be advisable to introduce it into another country as a fibre plant, but its successful use as such might afford some compensation to those countries which have unfortunately acquired it.

T. PETCH.

AMBALANTOTA COTTON.

In the June number of this Journal we published an account of the cultivation of a small trial plot of Allen's Long Staple cotton at Ambalantota. The Secretary of the Ceylon Agricultural Society has now received from MESSRS. FREUDENBERG & Co., who are the agents for The British Cotton Growing Association, the following report which will be read with interest:—

"We have received the following report from the British Cotton

Growing Association on your consignment of Seed Cotton (No. 186.) The Cotton was ginned by us in Colombo and the lint only sent to Liverpool:—

September 10th, 1913.

		Ambalantota	
Receipt No. 186	1 bale marked	C	194 lb.

AILS.

"Fairly clean, bright Sea Island description good staple fairly long."

"Value—9d."

.. .. 186	1 bale marked	—C—	179 lb.

"Cleaner and more silky in staple than above lot."

"Value—9½d."

This compares with American middling quoted at 7·35d. for the same date.

The Cotton was sold at 9½d. per lb.

As a result of the foregoing, 31 acres have been planted up with cotton in the Hambantota district by private planters. A larger area would have been opened had there been time before the rains.

RED STAINS ON SISAL FIBRE.

Growers of Sisal Hemp, both in German East Africa and Java, have found that although their fibre is pure white when baled on the plantation it frequently develops red or rusty stains during its transport to Europe. In many cases whole consignments have been injured in that manner. Investigations in Java have shown that this discolouration is caused by bacteria, so that the case is parallel to the occurrence of similarly-coloured spots on rubber.

As is generally known, the fibre is extracted from the leaves by machinery, is then washed, and afterwards dried in the sun. It is most probable that infection is brought about through the presence of bacteria in the water used for washing. These bacteria are not killed by the subsequent exposure to sunlight and, given favourable conditions, such as sufficient warmth and moisture, they develop later and produce the red stains.

It follows that, after once being dried, sisal fibre should be exposed to moisture as little as possible. It is very absorbent, and soon takes up enough water to permit of the development of these bacteria. If it is allowed to become wet during shipment, the heat of the ship's hold immediately provides a favourable environment for bacterial development; and if any colour-producing bacteria are present, the fibre may be expected to become stained under such conditions.

To prevent the introduction of bacteria, disinfection of the washing water at once suggests itself. This has been adopted on some estates, with the result that no further complaints of red fibre have been received from the buyers. As the question is of interest to rubber planters, particulars of a disinfecting installation which is in use on one estate are quoted below from DER TROPENPFLANZER, Feb. 1913.

The estate in question uses river water for washing the fibre. The disinfecting plant consists of four tanks in a row. The first of these is filled with gravel, and serves to filter the water, which enters it at the top and percolates down to the bottom. From the bottom of the first tank, a pipe runs through the bottom of the second up to about one-third of its height This constitutes a settling tank, in which the finer particles of mud, etc. which pass the gravel filter are deposited. From the second tank the water overflows into the third, and from that into the fourth. In these last two, the water is treated with potassium permanganate and lime, and is ready for use in three or four hours, when it is drawn off from the top. These two tanks have a capacity of twelve cubic mètres (about 2,600 gallons). 10 grams (one-third of an ounce) of Potassium Permanganate and 10 kilogrammes (22 lb.) of lime are added for every 10 cubic metres (about 2,200 gallons) of water.

T. P.

"POCHOTE:" A NEW KAPOK PLANT.

In Eastern countries, Kapok is obtained from *Eriodendron anfractuosum* (*Ceiba pentandra*) sometimes called the "white" cotton tree, to distinguish it from *Bombax malabaricum*, which from its red flowers is known as the "red" cotton tree. The cotton from Bombax is less valuable than that from Eriodendron, and is frequently mixed with the latter as an adulterant. A new Kapok plant is now being spoken of from Mexico, where it is known as "Pochote." This is *Ceiba occidentalis* or *Ceiba aesculifolia*, according to a recent communication in DER TROPENPFLANZER.

This differs from the common cotton trees in that it is only a shrub, about five or six feet high. It is said to live for five or six years and to be easily propagated by root suckers. It grows well in regions which are suitable for cotton or sugar cane. The seeds produce an oil which is said to resemble cotton-seed oil in its properties, though hitherto it has only been used by the natives medicinally.

It has been planted in Mexico as a source of oil, and has been introduced into German tropical colonies as a Kapok-producing plant. If it proves a success in the latter capacity, one of the chief difficulties of Kapok cultivation, i.e., the collection of the produce, will be removed.

T. PETCH.

MANURING COTTON IN ITALY.

U. VARVARO.

During the past few years there has become manifest a distinct movement in favour of the cultivation of cotton in Southern Italy with the object of re-awakening the interest of farmers in the crop and allowing it to assume once more the place it once occupied in Sicilian agriculture. In 1864 there were 83,650 acres under cotton in Sicily, producing 23,632 tons of lint, while at present the annual production has dropped to about 3,000 tons.

Manuring is usually neglected, though cotton requires a soil which has been well prepared and well manured, and the success of the whole rotation will be largely dependent on the manner in which these two processes have been carried out. In fact the cotton plant is a voracious feeder : a good crop of 1,340 lb. per acre removes from the soil :—

Nitrogen	...	63 lb.
Phosphoric acid	...	28 lb.
Potash	...	59 lb.

Counting the wheat which follows in the rotation at a proportional yield of 45 bushels per acre, the elements to be returned to the soil per acre would be as follows :—

Nitrogen	...	146 lb.
Phosphoric acid	...	72 lb.
Potash	...	115 lb.

The writer carried out some manuring experiments during the period 1911-1912, at Menfi (province of Girgenti) with the variety "Biancavilla" on a uniform calcareous loam of medium fertility and situated almost on level ground. The plots measured 100 sq. metres (1/40 acre approx.) each, and received the following treatment :

Plots	1, 7, 13	no manure
,,	2, 8, 14	660 lb. farmyard manure.
,,	3, 9, 15	green manuring with beans.
,,	4, 10, 16	*id.* + 13 lb. of mineral superphosphate
,,	5, 11, 17	*id.* + *id.* + $4\frac{1}{2}$ lb. sulphate of potash
,,	6, 12, 18	*id.* + *id.* + *id.* + $6\frac{1}{2}$ lb. gypsum

The fertilizers were applied in November when also the beans were sown ; the farmyard manure was spread previously.

The green crop was turned in on February 12th and the cotton seed was sown on March 17th.

The returns were as follows:—

	No. Manure.	Farmyard Manure.	Green Manuring.	Green Manuring. Superphosphate.	Green Manuring. Superphosphate. Sulphate of potash.	Green Manuring. Superphosphate. Sulphate of Potash. Gypsum.
MEAN PRODUCTION PER ACRE:						
Total ... lbs.	648	784	735	865	999	1003
Seed ... ,,	183	240	219	251	330	329
Lint ... ,,	465	544	516	614	669	674
,, ... %	28·2	30·6	29·8	28·9	33·0	32·8
Time of harvest.	Aug. 26 to Oct. 9	Aug. 17 to Oct. 9	Aug. 10 to Oct. 9.	Aug. 10 to Oct. 9.	Aug. 4 to Oct. 9	Aug. 4 to Oct. 9
RECEIPTS AND EXPENSES PER ACRE.						
Total value of production *	£5. 7s.	£6. 19s.	£6. 8s.	£7. 6s.	£9. 10s.	£9. 10s.
Total cost of manure.	—	£3. 15s.	£1. 1s.	£2. 0s.	£3. 0s.	£3. 5s.
Value of unexhausted residue left in soil	—	£2. 7s.	5s.	18s.	£1. 7s.	£1. 9s.
Value of manure removed by cotton crop.	—	£1. 7s.	18s.	£1. 2s.	£1. 13s.	£1. 16s.
Profit due to manuring.	—	5s.	5s.	17s.	£2. 10s.	£2. 6s.

The figures and general conditions of the experiments lead to the following conclusions:—

I. The application of 12½ tons per acre of farmyard manure raised the yield appreciably and favoured the early ripening of the bolls.

* The prices obtained were: 150 lire per quintal (2·2d. per lb.) for the lint, and 5 lire per quietal (2·10s. per ton) for the seed.

II. The green manuring with beans gave similar, though less marked, results; the early ripening however was still more marked.

III. The addition of 5 cwt. per acre of superphosphate to the green manuring increased the yield, showing that the soil requires phosphoric acid.

IV. The further addition of 1½ cwt. per acre of sulphate of potash to the dressing again raised the yield and the power of early maturity of the plant, showing that the soil required a supply of readily assimilable potash.

V. The application of gypsum gave no useful results.

VI. The application of all manures proved remunerative, green manuring together with superphosphate and sulphate of potash heading the list.

Finally, green manuring with beans takes the place of farmyard manure, which is wanting in Sicily, and supplies the soils with the organic matter they lack.—MONTHLY BULLETIN.

MANILA HEMP IN THE PHILIPPINES.

M. M. SALEEBY.

In value and importance the abaca crop of the Philippine Islands is second only to rice, and the necessity of re-organising the former industry on a sounder basis has recently been emphasised by a series of calamities, in the shape of typhoons and drought, which have struck the islands.

The writer points out some of the contributing causes for the present condition and suggests some practical remedies:

SELECTION OF SUITABLE SITES.

Plantations should be established on rich soils where they will receive an abundant rainfall uniformly distributed.

CULTURAL METHODS.

Plants should not be set less than 13 feet apart; deep cultivation, which proved most valuable during recent droughts, should be practised, and the land irrigated wherever possible. The renewal of old plantations should not be carried out by setting new shoots between the old ones, but by establishing an entirely new plantation.

IMPROVEMENT OF THE QUALITY OF THE FIBRE.

The following table will show that careful extraction yields a higher percentage of the good quality fibre, whereas the higher percentage of the poor grades is actually exported:

	Yield with careful extraction.	Exported in 1912.
Low grades ...	5 ...	32
Current grades ...	10 ...	40
Good current grades ...	25 ...	18
Good grades ...	35 ...	10
Best ,, ...	25	

The better qualities down to "good current" are put to special exclusive uses; the demand for them is considerably above the supply, and prices are

not only very high but very stable, whilst the poorer qualities have to compete with other products, showing conclusively the immense advantage of increasing the output of the higher grades. To attain this end so long as a good defibrator is not available it will be necessary to concentrate efforts towards improvement on

THE ADJUSTMENT OF RELATIONS BETWEEN BUYERS AND PRODUCERS.

Producers frequently know of means which would enable tham to obtain high quality fibre; but, as the local buyers will not pay a sufficiently high price, the planter finds it more profitable to turn out lower grade produce. The buyers or middlemen on the other hand refuse the higher prices partly because, being at the same time merchants, they prefer to keep the poorer class of producers dependent on them and partly because they cannot themselves distinguish between the various grades of fibre and feel safer in buying the lower grades where the differences are more apparent. The writer suggests the following reforms in this connection : (1) the enlightenment of the uneducated class of producers by means ot experimental fields, etc.; (2) the formation of planters' co-operative associations ; and (3) the creation of uniform standards for each quality.—Monthly Bulletin.

SISAL HEMP IN FIJI.

(BY THE SUPERINTENDENT OF AGRICULTURE).

There are several plants, natives of Central America and chiefly Mexico, yielding what is known on the market as sisal hemp, so called from the port of Sisal, from which it was first shipped.

In Yucatan the plant is called "Henequen," and there are two principal varieties : the "white," the botanical name of which is "Agave rigida variety elongata," and is the plant chiefly cultivated for fibre in Yucatan (Mexico) ; and the "green," "Agave rigida variety sisalana," the plant cultivated extensively in Florida and the Bahamas. It is the latter which is recommended for use in Fiji.

The variety "elongata" has teeth along the edges of the leaves which possess a whitish bloom, while the variety "sisalana" has bright green leaves each provided with a purple terminal spine. The latter variety is said to give the best agave fibre.

The fibre, which is white, strong and flexible, is contained in the leaves, which vary in length up to five feet and in breadth up to about five inches They are borne on a short thick stem, and a succession of leaves is given off from the heart of the plant. During the growth of the plant suckers spring up around its base, and these may be removed when large enough and used for planting purposes.

On reaching maturity a flower stalk or "pole" grows up from the centre of the plant to a height of about twenty feet. Flowers are borne on branches growing out at right angles to the pole from its upper part. After the flowers

have fallen it is found that numerous bulbils develop at the ends of the branches. These bulbils or "pole plants" may be used for propagation purposes.

The "poling" of a sisal hemp plant marks the last stage of its life history and it then dies.

PROPAGATION.

It has been mentioned that either "pole-plants" or suckers may be used for propagation purposes.

Pole plants were the only ones used in many instances, and Sir D. Morris says: "They were small in size and conveyed in large quantities in the holds of schooners, where they got over-heated and weakened. Such plants were necessarily predisposed to early maturity. I am also of opinion that pole plants, produced as an expiring effort of the parent plant, are not always calculated to produce such robust plants as suckers; at least they are not likely to be so when derived from plants whose leaves are periodically reduced when cut for fibre purposes."

Suckers therefore seem to be more desirable as young plants and should be taken, when there is any choice, from the most vigorous plants. They will be found to spring up in twelve months or so after planting, and when large enough may be removed.

Mr. A. J. Boyd, in "Sisal Fibre Industry in Queensland," 1906, remarks that, "When a mature plant, surrounded by suckers, sends up a pole, the older suckers at once follow suit and send up slender poles, which will produce a small number of flowers and bulbils."

From this it will be seen that suckers should not be taken for planting purposes from a plant that has poled

At the Experiment Station the young plants used were about 12 inches long, having been placed in nursery-beds until they attained this length. It is recommended that this plan be followed, the nursery-beds being filled with suckers removed from the cultivations. A supply of young plants is then ready at any time for filling vacancies, for re-planting, or for extending the cultivation, or for sale.

With the commencement of planting, where the supply of plants is limited, a plentiful supply of suckers springing up around the existing plants may perhaps be looked upon as a desirable condition. It must be remembered, however, that when the sisal-hemp plants are grown for fibre purposes the presence of suckers around the plants, for reasons to be given later, should be discouraged as much as possible. With all precautions that may be taken the plants will give sufficient suckers to allow vacancies to be filled and gradually to allow of the replanting of exhausted areas.

The young plants, when about to be set out in the fields, should have all the lower leaves and the roots trimmed off with a knife. This allows the plant to take root more quickly and is said to lessen the number of suckers produced.

LAYING OUT OF PLANTATION AND PLANTING.

One of the most important points in regard to the cultivation of sisal hemp is the arrangement for transport of the leaves to the mill.

For the purpose of arriving at an estimate of the amount of raw material in the shape of leaves to be transported, let us take the moderate yield of half a ton of fibre to the acre with a percentage of two-and-a half of fibre ; we have then nearly eighteen tons to carry from each acre.

When a plantation covers hilly land, it is presumed that the factory will be located on the lower level and advantage may then be taken of the natural fall to transport the leaves by means of wire-ropes. Roads will, however, be necessary along which carts may be taken or trucks run upon suitable rails.

These roads must, to a certain extent, follow the contour of the hills, and from them side roads may be necessary to reach all parts of the cultivation.

The plants are set out in rows at a uniform distance apart, and will be too close to allow carts to get into the actual cultivations. Some carrying by hand will therefore be necessary, but it should be made as short as possible, Side roads may either cut across the rows or be made by leaving wider spaces between certain rows at intervals. In the former method, if the side roads are 10 chains apart, it will be seen that the cutters have not more than 5 chains to walk to reach a road. This is practically a system detailed in MR. BOYD'S pamphlet already referred to and suggested by Mr. D. J. STODDART, a Jamaica planter. Crossing the rows of plants to reach a road, as would be necessary in the second system mentioned above, is more convenient than going along a row; and if the roads are placed nearer together more planting space is of course taken up by them.

The distances apart of the rows and of the plants themselves in the rows, will depend entirely upon the soil—the poorer the soil the nearer together the plants may be placed.

Distances recommended by various authorities will be found to vary from 10 feet to 6 feet by 6 feet or even nearer.

At the Experiment Stations the distances used are 8 feet by 8 feet and the plants in one row come opposite to the gaps in the adjacent ones. This gives 681 plants to the acre. There is difficulty in getting into the cultivation only when the time is approaching for the first cutting. Of course care is always necessary in going among sisal hemp plants on account of the strong and sharp terminal spines.

Planting should take place during the wetter months, (November to March), but showery weather at any time of the year may be taken advantage of. The plants are very hardy and are specially adapted by nature to withstand dry weather.

At the places where the young plants are to be placed, the soil should be loosened and the plant planted, taking care that it is upright, that it is not set too deep, and that no soil falls into the crevices between the leaves.

Ploughing the land previous to planting is not necessary, but all weeds should be cut down, as the plants require as much sun and air as possible.

CULTIVATION.

The sisal hemp plant requires little attention when it has been planted out, and the cultivation is confined to preventing weeds from shading the plants, and removing suckers.

It naturally follows that cultivation will be cheapest where the growth of weeds is least, hence the drier parts of the group will probably give best results.

As the plants will not thrive in areas where the soil remains wet, it may be necessary here and there to make drains to assist the natural drainage These must be kept in proper working order by clearing out when necessary.

Sisal hemp is usually recommended for places where the soil is too poor to allow other crops to pay, and the use of catch crops between the rows of sisal hemp is therefore out of the question. If the land is good enough, however, there is no objection to the use of one when the sisal hemp plants are young, provided the latter are not liable to be shaded by the catch crop.

With the growth of the industry there will be much demand for suckers for planting purposes, for while they remain attached to it they absorb some of its strength and probably induce early poling. They may be separated from the parent plant with a knife or sharp spade.

Plants growing on rich land seem to produce more suckers, and they must be inspected and suckers removed more frequently than on poor soil. If not required for planting or sale, the suckers must be thrown away.

HARVESTING THE LEAVES.

The fibre is an essential element in the structure of the leaf, and is of course present in leaves of all ages. There is, however, a definite time when the fibre is at its best and the leaves should then be cut. As the leaves mature and gradually become unable to carry out their proper functions young ones are put out to replace them. It would appear then that we should be able to remove the older ones without any serious injury to the plant, and in practice this is found to be the case.

The fibre, too, is at its best in the mature leaves, when the plant can, as it were, best spare them.

Care must be taken that the immature leaves are not cut, a point that will be referred to again.—FIJI PLANTERS' JOURNAL.

FRUITS.

THE DATE PALM.

PAUL B. POPENOE.

The requirements of the date palm are—Intense summer heat, long continued; absence of summer rain; and abundance of irrigation. Under these conditions it can endure a fair amount of cold in winter, and alkaline soil or brackish water without discomfort. North African varieties, which are those mainly grown at present, prefer a good sandy loam; but some of the Persian Gulf dates do better in a clay or adobe.

The palm is usually propagated by offshoots which will begin to bear in three or four years, and continue profitably for a century, reaching their greatest vigour at the age of fifteen or twenty years.

The offshoots are taken from the parent tree when they reach 15 or 20 lb. in weight, and are set in nursery rows until rooted, which will require nearly a year. They must be kept in moist ground constantly during that period—one day of drought during the hot summer may destroy the tiny roots in formation, and leave a dead offshoot. When rooted, they are transplanted to the open ground 30 or 40 ft. apart and require little care except frequent irrigation and cultivation.

The only part of the culture which involves much labour is pollination of the female blossoms in the spring. This is done by cutting off a male blossom, shaking it over the female, and tying it in place where the pollen can fall naturally. By this means one male will supply enough pollen for fifty or more palms, while, if the wind and insects were depended on for the fertilisation, the number of each sex would have to be nearly equal. This fertilisation, however, is not a task that requires any great skill.*

Beginning with the fourth or fifth year, the palm will produce a small amount of fruit. The Deglet Noor—the best of the varieties—is more precocious than others. It will not reach full bearing for some years more and even then a part of the clusters are always cut off each spring to prevent overtaxing the palm. Eight or ten are enough to leave, and the yield should average nearly 100 lb. per tree. Yields of 500 have been reported, but 1 cwt. must be considered satisfactory. This will continue for a century or more.

ARTIFICIAL RIPENING OF THE FRUIT.

The discovery of the means to ripen the fruit artificially is the greatest boon given to the industry, and this alone perhaps has made possible complete success in California; for, if the berries ripen on the tree, they do so unevenly and the waste from this source and from untimely rains, fermentation, and depredations of insects is enormous, in some cases having reached 90 per cent.

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* *See* "Queensland Agricultural Journal," March, 1901, for explanation of the method adopted in the Sahara Desert of Africa for irrigating, fecundating, and generally treating the date palm.

With artificial maturation, however, the dates are picked when they have reached full size, but before they have begun to soften, and are placed in an oven or incubator fitted with vapour, for eighteen or twenty hours, when they come out fully ripe and in perfect condition to be packed, shipped, and eaten. This method is the result of long experimentation by agents of the Bureau of Plant Industry and the University of Arizona, and is so inexpensive that it can be applied profitably to even the cheapest varieties. It allows all the dates on a cluster to be harvested at one time, and leaves them intact and not sticky.

CHANGING THE SEX OF DATE PALMS.

The inhabitants of the southern oases in Algeria maintain that this can be readily done. Of 100 date palms, 80 are male trees; hence it may readily be conceived that it is greatly to man's interest that the cultivator's intervention should be crowned with success. The method consists of tearing off all the leaves from the footstalks at two or three years of age, so that the medial nerve is split in two from the centre to the leaf sheath. The idea of the Arabs is that this tearing process brings on a concentration of the sap movement in the same way as in the case of an annular incision, and results in an accummulation of sap, which is more necessary for the vital functions of the female plant than for those of the male. No objection, from a vegetable pathological point of view, can be raised against the above assertion, for the reason that, in young plants, the organs are not yet different from each other.

THE PROFITS OF DATE-GROWING.

Finally, a few words on that important subject, the profits that are likely to accrue to growers. The date industry offers large enough returns to suit any reasonable man, particularly as the cost of operations is less than with most fruits.

The lowest estimate of profits ever made is 150 dollars (£30) per acre a year, but with the decrease in waste, consequent upon artificial maturation, this old figure may stand as an irreducible minimum. Under present conditions a plantation of good varieties under careful management should net several times that much per acre. The Deglet Noors, which were put on the Los Angeles market last fall, brought 1 dollar (4*s.* 2*d.*) per lb., netting the grower 79 cents per lb., or about 35 dollars (£7) per ton. In Algeria the grower of Deglet Noors thinks he is doing well if he gets 5 dollars (£1) per tree. It seems reasonable to suppose that for some years Deglet Noor and other dessert varieties put up in an attractive way, will bring from 30 cents (1*s.* 3*d.*) to 50 cents (2*s.* 1*d.*) per lb.; while coarser varieties, or second-grade berries, will perhaps retail at from 15 cents (7½*d.*) to 30 cents (1*s.* 3*d.*) per lb.

With forty or fifty trees to the acre, and an average yield of 100 lb. per tree, I believe the man who grows dates, with proper knowledge and attention to his business, can look for a profit of at least 400 dollars (£80) to 500 dollars (£100) per acre per year for a good many years to come.—QUEENSLAND AGRICULTURAL JOURNAL.

PINEAPPLE CULTIVATION.

The pineapple will thrive on comparatively poor soil, but must be well manured every year. Careful preparation of the land and deep stirring prior to planting will be found to pay well. The plants soon take root, and once established are very hardy. When heavy frosts are expected, some hay thrown over the plants is sufficient protection. They are propagated by means of suckers coming from the base of fruitbearing plants, or from smaller suckers called "robbers" or "gill sprouts" that start from the fruiting stem just at the base of the fruit. Crowns of the fruit may be used as plants, but this is not recommended, as the plants are often two or three years before bearing, and then only one fruit for a first crop. Gill sprouts are the best to plant, as they always develop a good root system before fruiting, and the first crop is always better than from root suckers. Once a pineapple plant has borne a fruit, the fruiting stalk dies and its place is taken by one or more suckers which, in their turn fruit and die. To form a plantation, set the suckers out in single or double rows 8 to 9 ft. apart, and the plants from 1 to 2 ft. apart in the row. The rows soon increase in width by the growth of suckers and the throwing up of ratoons (surface roots, which send up plants from below as distinct from suckers. It is not at all uncommon to see the rows grown together, so that the plantation seems to be a solid mass of plants, and pathways have to be kept between the rows to permit of gathering the fruit and manuring. Once the pine is planted, the cultivation is simple. If in single or double rows, all weed growth is kept down between the plants, and the ground between the rows (the 9-ft. spaces) kept in a state of good cultivation, the soil being worked towards the rows to encourage the formation of suckers low down on the fruiting plants. The manure is worked in on either side of the rows. The pineapple plants will give a first crop in from twelve to twenty months, according to the type of suckers planted, Every sucker will produce a fruit. One thousand Queen pines in a plantation in full bearing is by no means an unusual crop in Queensland ; and, averaging them at 2½ lb. each, you get a return of 30,000 lb., or 15 tons per acre Smooth-leaved pines run to as much as 14 to 16 lb. each, but the average weight is from 6 lb. to 8 lb. each.

The rough-leaved Common Queen and Ripley Queen are very prolific, and generally average 4 lb. per pine, some attaining 6 lb.

Plants cost from £1 10s. to £4 per 1,000, according to variety ; 4,500 plants are required per acre ; planting after preparing the land costs about 10s per acre.

When planting suckers, remove the dead short leaves at the base so as to give the young roots a chance to start.—QUEENSLAND AGRICULTURAL JOURNAL.

DRY FARMING.

TO MEMBERS OF THE SOCIETY.

Dry farming has been defined as the conservation of soil moisture during long periods of dry weather by means of tillage.

2. The object of the system is to bring about a certain mechanical condition in the soil which will favour the growth of crops in dry districts.

3. To begin with the soil should be loosened to a considerable depth in order to catch rain water when it falls; so that instead of running away as it would on a compact surface soil the water may sink in and be carried downwards and there stored for future use.

4. After this the upper 2 to 4 inches of soil should be frequently stirred to preserve it in a state of mulch, that is in a loose condition, so that the moisture below may not rise to the surface and become evaporated, as it would if the soil become compact.

5. Thorough ploughing or forking up followed by the frequent use of the harrows will help to bring about this result.

6. Never allow the soil to become crusted, and the more serious the drought the more frequently should the surface layer of soil be loosened.

7. Do not permit the land to grow weeds since the presence of grass or weeds so far from protecting the soil aids in the dissipation of moisture by transpiration through the leaves.

8. Sandy loams and clayey loams can be dry-farmed but not gravels, pure sand or impervious clays; level or gently sloping land is more suitable than steep hill-sides.

9. In regions where dry farming will be found most serviceable, conditions of soil and climate favourable to the process usually prevail.

10. As a rule the soil is light and there is a good depth of it; there is no impermeable substratum; and such humus as is present is richer in nitrogen than that in wet districts.

11. The bulk of the rainfall is precipitated within a short space of time.

12. It is therefore necessary to prepare the land by ploughing or forking to receive the water and store it, and afterwards, by frequent surface cultivation, prevent its dissipation.

13. To facilitate the use of implements regular planting should be done and in the case of annual crops the seed should be drilled or dibbled in rows as straight as possible to allow of tillage between the growing plants.

14. The Society would be glad if members who own property in the dry zone will undertake to cultivate a small part of their land according to the principles of dry farming with a view to demonstrating its advantages to their neighbours.

C. DRIEBERG,
Secretary, C. A. S.

Ceylon Agricultural Society, Peradeniya, 22nd November, 1913.

ENTOMOLOGY.

ZEUZERA COFFEÆ (RED BORER; COFFEE BORER.)

This insect is widely dirtributed in Ceylon as a pest of tea, and it is often sent to the Entomologist under the impression that it is the shot-hole borer though the resemblance is slight as well between the insects as between their manner of work. In the respect that its attack results in the death of the branch attacked it is more serious than the shot-hole borer.

Its presence is indicated by the withering of the leaves and by the castings of the caterpillar which lie on the ground. The castings are oval-cylindrical in shape and yellowish or crimson in colour.

If such a branch is cut open, a tunnel, widening out at irregular intervals will be found, running along its centre. These wider portions are of the nature of lateral galleries that may reach almost to the outside. The width of the tunnel depends on the age of the caterpillar. The galleries of the young larvæ are usually straight, and without the wider regions that are characteristic of the galleries of older larvæ. Narrow and wider galleries may be found in the same branch. They may be continuous or they may not. The narrower galleries are obviously the older, and are found in the thinner twigs; their entrances are small, but I have never seen any so small as those of shot-hole borer; they have been found at leaf scars, and in the angle between a twig and the main stem. In certain cases the larvæ seem to work continuously downwards; in other cases they seem to leave a tunnel in the upper part of the branch and come lower to enter at another point from which they burrow upwards as well as downwards

In several cases where a caterpillar has been present it has been in a tunnel that was being driven upwards. In one case a larva in its upward journey had entered a pruned stem; but, evidently finding the condition of the wood not to its liking, it had stopped short about ¼ in. from the cut surface had returned on its track and gone into a living branch, where it was found feeding.

The galleries may be so extensive as to girdle the stem; they may also go down into the roots.

When full grown the larva cuts a circular trap door for the exit of the moth, and spins a loose silken web on the walls of the burrow and pupates. The pupa lies with its head towards the trap-door, from which it is sometimes separated by a plug of frass.

In the course of the galleries one often finds a tunnel leading to the outside and almost closed at the inner end by a silken membrane with which frass is incorporated.

Are these the holes at which the castings are ejected?

A variety of insects has been found in the tunnels and in some cases these have been mistaken for the real culprit. In one case an old gallery was tenanted by a colony of six or seven slender, blackish brown ants with larvæ and pupæ. A nymphal locustid was using another gallery as a retreat, and in still another a cockroach had deposited its egg-capsule.

Specimens of branches have been sent in that suggest that white ants had made use of the galleries of the caterpillar to commence operations on the branch.

The appearance of the caterpillar varies, but the following description will enable one to recognise it:

It is that of a full-grown or nearly full grown caterpillar, about $1\frac{7}{2}$ in. in length.

The head, first and second thoracic segments and eighth, ninth and tenth abdominal segments are brownish. The rest of the body is of a glossy pinkish or purplish colour.

On the dorsum of the first thoracic and ninth and tenth abdominal segments are smooth, glossy shields.

The prothorax is somewhat humped and its shield bears dark brown areas on its anterior and posterior edges. The posterior dark brown area is composed of backwardly-directed processes, broad and rounded at the apex. These, no doubt, assist the larva to progress in its burrow. The most anterior row contains the largest spines and they are arranged thus from the middle line—two large, one smaller, two larger, many smaller.

The ventral surface is brownish-yellow.

There are three pairs of true legs, four pairs of abdominal prolegs and a pair of anal prolegs. The hooks on the abdominal prolegs are arranged in a circle, those on the anal prolegs in a transverse, slightly curved band.

The body is sparsely covered with long, white setæ.

The mandibles are stout, black and toothed.

When molested the caterpillar exudes a dark-brown fluid from its mouth.

The caterpillar described above gave rise in confinement to a pupa 11/12 in. long.

The larvæ do not thrive well in confinement, and the smallness of this pupa, as compared with the size of the larva, was probably due to shrinkage in the larva owing to a dearth of suitable food, as it did not pupate till several weeks after it had been obtained.

This pupa is of a chestnut-brown colour and shining.

It is of much the same diameter throughout till near the apex of the abdomen where it narrows rapidly.

The anterior end is of a very dark brown colour, is sculptured and provided with a short snout.

The abdomen is provided with 12 or 13 transverse bands of backwardly-directed spines. These bands stop short a little distance below the level of the spiracles, but on the ventral surface there are on each segment two groups of three spines each besides two isolated spines. Ventrad of the anus there are several distinct spinous tubercles.

These spines provide the mechanism by which the pupa crawls to the exit hole just prior to the issuing of the moth. The abdominal region is very soft and easily injured.

The imago of Zeuzera coffeæ may be recognised from the following description, which is adapted from HAMPSON :—

Male.—Expanse 40 mm ; each of thoracic segments with a pair of small black spots. Abdomen black, clothed with white hairs. Fore-wing with small black spots. Hind-wing with a few black spots.

Female.—Expanse 46 mm. Spots on fore-wing fewer but more prominent and tinged with metallic blue.

The moth flies by night.

HAMPSON gives its distributions as Naga Hills, Rangoon, Nilgiris, Ceylon and Borneo.

He refers, in error, to its larva as the "White Borer." "White Borer" is the larva of a Cerambycid, Xylotrechus quadripes, Chevr.

It is difficult to form a reliable estimate of the damage done by "Red Borer" in tea. One correspondent remarks, "It is causing considerable loss in the nurseries." Another is more definite and estimates that 15 per cent. of the trees in one field are attacked.

In the office we have records of its occurrence in the following districts:— Ambalangoda, Avisawella, Bandarawela, Colombo, Demodera, Dikoya, Gonakelle, Gammadua, Haputale, Horana, Haldamulla, Kandy, Kandapola, Matale, Maturata, Madulkele, Neboda, Nawalapitiya, Nugegoda, Peradeniya, Rangala, Rattota, Ruanwella, Ukuwela, Uda Pussellawa, Wattegama, Welimada.

It has been found feeding on the following plants in Ceylon.—Tea, coffee, loquat, cotton, avocado pear, "china apple," orange, grevillea, teak, Cassia auriculata, cinnamon, Erythroxylon. S. P.

In India it is recorded from tea, coffee, sandal and cotton.

Control.—It will be observed that it is a very general feeder and, therefore, difficult to deal with.

It should be destroyed wherever, and in whatever stage, found.

Affected branches should be cut down till untunnelled wood is reached, and the larva or pupa in the tunnel killed.

Sometimes, as when the tunnel goes below the ground or into the body of the bush, this is not possible.

In such cases the pruning should be carried as low down as possible, and the tenant of the gallery killed by prodding with a sharp wire or by putting into the gallery a piece of cotton wool saturated with Carbon bisulphide and closing the hole.

A. RUTHERFORD.

THE RHINOCEROS BEETLE.

During recent years, coconuts in Samoa have been severely attacked by the rhinoceros beetle which is said to have been introduced from Ceylon with the material used for packing Hevea stumps. Among the many measures which are being tried in the attempt to eradicate it, or at least diminish its numbers, the most promising is that of trapping it by means of specially prepared heaps of decaying vegetable refuse. The beetle lays its eggs in the traps, and the larvae are subsequently collected and destroyed.

DR. K. FRIEDERICHS, who is in charge of the investigations in Samoa, has found that with the aid of these traps he can also determine and collect the natural enemies of the rhinoceros beetle. Among these he finds a fungus which gives promise of being of great service in destroying the larvæ. If this fungus is introduced into the artificial breeding places, it attacks the larvæ and kills them, thus making it unnecessary to dig up the traps to collect them.

DR. FRIEDERICHS is now about to undertake a tour through the coconut growing districts of Asia and East Africa with the object of studying further the rhinoceros beetle, and of collecting, if possible, its natural enemies in other countries, in the hope that something may be discovered which when introduced into Samoa will keep it in check. He expects to arrive in Ceylon in March or April next year, and it would be of great assistance to him if owners of coconut estates could establish one or two traps in localities where the beetle is prevalent so that he might have ample material for examination during his visit. It is unnecessary to point out that the information gained by these extensive investigations will be of the greatest service to coconut planters in general, and may lead to methods of dealing with the beetle which will be immediately advantageous to Ceylon estates.

The traps are easily prepared and do not entail much expense. Each trap should be about four feet square. A square hole about four inches in depth is first dug, so that the lower part of the trap may be below the level of the ground. In this, round the sides, are placed four pieces of coconut stem, and on these other pieces are placed so as to form a wall about fourteen inches high. The interior of this enclosure is then filled with pieces of decaying coconut stems, decaying wood, dung, dead leaves, pieces of plantain stems (if available) and soil. The decaying shells of cacao pods are especially suitable, but they must not be used until at least two months after being gathered, as otherwise they develop too much heat during decay, If the soil is not damp, it should be watered, and the trap covered with palm leaves so that it is kept damp. The soil should form a thin covering over the top.

The traps should be built in situations where it is evident from the condition of the coconut leaves that rhinoceros beetles are present, and they should be in the open so that the beetles can have free access. After about three months, they will be found to contain large numbers of eggs and larvæ. The presence of the traps does not injuriously affect the surrounding palms since the beetle takes more than six months, probably almost a whole year, to complete its development.

A further communication from Samoa states that coconut planters in tha country are now building these traps at the rate of one to the acre, and that the Government is also putting them in many places about 120 paces apart. As many as 460 beetles are said to have been taken from one trap in three months.

It is of course necessary, if it is desired to eradicate the beetle from a given area, to clear up all other decaying refuse so that the traps afford the most convenient breeding places. They might conveniently be made the receptacles for all coconut debris.

DR. FRIEDERICHS is anxious to have a large number of larvæ at his disposal when he arrives in Ceylon. For this it would be necessary to establish the traps in December so that they might contain larvæ in March. It is hoped that many coconut planters will see their way to institute one or more on their estates, and the DIRECTOR OF AGRICULTURE would be extremely obliged if they would kindly communicate their intention to him.

T. PETCH

MITES.

Complaints regarding the injury of tea by mites of various kinds are received from time to time by the Entomologist, and the condition of individual bushes and patches of bushes in the neighbourhood of Peradeniya convince one that a considerable amount of injury is done by mites that never reaches the attention of the Superintendent or of the Entomologist.

Dry, finely-divided sulphur has been regarded as a specific against mites. Recent work in the United States of America, however, has shown that it is not to be relied on in all cases.

While it has been found to be effective against red-spider (Tetranychus bimaculatus, Harvey) on prune, pumpkin and sweet peas, it has not given good results against the same mite on cotton and hops.

Observations have led to the conclusion that "sulphur is effective upon the red spider only when the infested surfaces of the plant are exposed to direct sunshine at some time during the day or to intense reflected heat."

One or other of these conditions is usually satisfied in Ceylon and hence it is that the use of sulphur here has been followed by satisfactory results.

Dry sulphur should be applied when the leaves are wet with "dew," or, failing this, they should receive a preliminary spraying with water; preferably too there should be no wind at the time of application.

In Ceylon the cost of an application of sulphur at the rate of 10 lb. per acre, preceded by a spraying with water, has been found to be about Rs. 1·75 per acre.

Sulphur is now applied in California along with hydrated lime, which serves to cement the sulphur to the leaves, and also acts as a carrier. Hydrated lime is formed by the addition of water to quicklime in certain proportions. It may be formed by adding 32 lb. of water to 100 lb. of quicklime.

Against red spider on hops in the United States of America a lime sulphur solution mixed with flour paste has been found to give satisfactory results.

A spray-mixture that killed 98·4 per cent. of the mites had the following composition.—1 gallon of lime-sulphur, testing 36 degrees Baumé to 100 gallons of water, flour paste being added at the rate of 4 gallons to 100 gallons of the spray.

This cost $0·29 (or Rs. 0·87) per 100 gallons.

Flour paste alone was found to give satisfactory results and at 8 gallons paste to 100 of water the cost was $0·176 per 100 gallons.

Two applications of sulphur, lime-sulphur or flour paste should be made, the second after an interval of 7 to 10 days, as these substances have little or no effect on the eggs.

The sprays, it is recommended, should be applied at a pressure of not less than 120 lb., and, as the mites must be hit, angle nozzles or bent rods are necessary in the case of mites infesting the under surfaces of the leaves.

The nozzle should throw a washing, rather than a misty spray, if all the mites are to be reached.

The following formula for the manufacture of flour paste is given by the American author :—

"Mix a cheap grade of wheat flour with cold water making a thin batter without lumps; or wash the flour through a wire screen with a stream of cold water. Dilute until there is 1 pound of flour in each gallon of mixture. Cook until a paste is formed stirring constantly to prevent caking or burning.

Add sufficient water to make up for evaporation."

The Pennsylvania State College Agricultural Experiment Station gives the following directions for making a concentrated lime-sulphur solution :—

Ingredients.—50 lb. best stone-lime (90-95% calcium oxide) 100 lb. sulphur (powdered commercial 99½% pure) water to make 50 to 55 gallons total product at finish.

Put 10 gallons water in iron kettle and start fire. Place lime in kettle. After slaking is well started, add the dry sulphur and mix thoroughly, adding water enough to make a thin paste, which requires about 5 gallons.

After slaking and mixing are completed, add water to make about 50 gallons, bring to a boil and stir until the sulphury scum practically disappears.

Then add water to make about 60 gallons and boil down to 50 or 55 gallons. The material should be kept well stirred especially during the early stages of the process.

The time of boiling should be until the sulphur granules are evidently dissolved, generally 40 to 60 minutes.

Pour or strain the clear liquid into a barrel or other storage vessel that can be completely filled or corked and cut off air with a thin layer of paraffin oil, or any other heavy oil.

Before dilution the density should be ascertained by means of a Baumè hydrometer.

Tarsonymus translucens Green (Yellow Tea Mite).

This tea mite is widely distributed in Ceylon.

We have records from Bandarawela, Dikoya, Bogawantalawa, Kotagala, Pussellawa, Galaha, Nawalapitiya, Ohiya, West Haputale, Kandy, Matale, Maturata, Peradeniya, Gonakele, Passara, Yatiyantota, Ratnapura.

It seems to be active during most of the year, and is probably the most common and most injurious of the mites affecting tea in Ceylon.

This mite occurs on both sides of the leaves of tea but is most abundant on the underside, where the small whitish eggs and the mites can be seen even with the unaided eye.

The mites occur chiefly on the two or three leaves nearest to the unopened bud, but also on the unopened buds on the young stem, and, sparingly, on leaves below the two or three that are most heavily infested.

On one occasion an unopened leaf on an infested twig was observed to be brownish-purple in colour and somewhat cracked along both infolded margins. No mites, however, were to be seen on this injured part. GREEN considers that the brown crease frequently seen on leaves between the margin and the midrib, looking like a supplementary rib on each side of the median one is due to the attack of this mite on the unopened bud.

Leaves on which living mites are still to be found in considerable numbers have a greenish-purple, watery appearance on the underside with areas of a distinct brownish colour here and there. On the upper surface brown is the prevailing colour and is very marked along the margins of the leaves ; elsewhere it occurs in spots.

Leaves on which mites are now scarce shew greenish-white spots and grooves on the upper surface, and these areas are sometimes covered with a scurfy, brown cork.

Leaves on which the attack has passed some considerable time previously and on which the eggs are now all shrivelled, shewing that they have hatched, have a more or less well defined, brownish area on the underside along the midrib.

Of a severe attack GREEN remarks:—"After a prolonged attack the flush becomes smaller and smaller with little space between the leaves ; and finally the tree refuses to put forth fresh shoots."

When the infested leaves are examined under a good pocket-lens, the mite can be easily seen, and with the aid of a microscope various details can be made out.

The adult female is somewhat oval in shape and of a shining, greenish-yellow colour with a more or less distinct dusky white band, constricted in the middle, along the mid-dorsal region. They are very active. They are provided with four pairs of legs, the fourth pair being slender and terminating in two long bristles, one of which is much the longer and often curves over the apex of its fellow.

Between and dorsad of the first and second pairs of legs is a very slightly-projecting, hyaline, rounded lobe ; in mounted specimens two eye-spots are visible one situated near the base of each of these projections.

The male is much smaller. Its abdomen narrows abruptly posteriorly so that the mite seems to have a distinct caudal projection. The fourth pair of legs is stout and they are carried held out behind. Each bears on the inner side a short spine or claw and a long bristle situated close together, and on the outer side nearer to the apex is another long bristle.

In addition to the males and females sluggish or even sedentary forms are to be seen. These are nymphs and the sedentary ones are moulting.

Frequently a male may be seen carrying along behind it supported on the apex of the abdomen a six-legged, whitish, smooth, immobile body, whose long axis is placed at right angles to its own.

Occasionally one sees a male pounce on another male that is carrying such a burden, and obviously try to wrest it from it. One such, failing in this, was seen to examine several of the unattached, white, sedentary mites but it rejected them all.

Are these bodies female pupæ about to moult into adults?

The eggs of the mites are comparatively large. They are broadly oval in shape, and have a bluish tinge when magnified. Under the compound microscope they are seen to be beautifully marked with some six rows of round, white, tubercle-like spots.

GREEN records this mite as badly attacking *Cosmos sulphurea*, a composite and I have seen the same or a very closely allied mite in injurious numbers on leaves and young stems of a small solanaceous climber (*Solanum venustum*).

The leaves become bronzed and withered and frequently drop off. This plant was exposed to the full force of the afternoon sun.

Mites of this group are usually vegetable feeders and many are of great economic importance.

(*Tarsonemus oryzæ*) Targ-Toz causes a disease of rice known as 'bleaching' in Italy.

(*T. spirifex*) March. produces distortion in the panicle of oats in France and Germany.

(*T. waitei*) Banks is associated with a peach bud disease in the United States of America.

(*T. bancrofti*) Much injures sugar cane in Barbados and is present on sugar cane in Queensland.

(*T. ananas*) Tryon is the fore-runner of a disease of pine-apples known as 'fruitlet core rot' in Queensland.

(*T. culmicolus*) Reuter causes a disease of grasses in Finland.

(*T. latus*) Banks was found injuring mango plants in Washington.

(*T. approximatus*) Bks Mss dand (*T. assimilis*) Bks Mss have been taken on Citrus in California.

(*T. buxi*) GREEN states, is recorded as having destroyed every box tree in the Botanic Gardens at Turin in one season.

PHYTOPTUS CARINATUS GREEN (RIBBED TEA MITE).

We have records of this tea-mite from Kegalle, Ukuwela, Nuwara Eliya, Haputale, Peradeniya, Gonakelle and Passara.

A bush badly attacked by this mite has every leaf, except the young flush, of a whitish green or, it may be, a deep bronze colour resembling those of copper beech.

Both surfaces are attacked but the discoloration is more marked on the upper surface.

Both surfaces especially along the veins are covered with a white powdery-looking substance, which by the aid of a pocket lens, is seen to be long and narrow in shape, and to represent cast skins.

The mites are very small.

Even when magnified ten times they are very difficult to see, and the difficulty is increased by the fact that they are very sluggish in their movements.

They may be examined by the aid of a compound microscope.

Then they are seen to be dark purple in colour and somewhat pear-shaped. Five, white, wavy bands run from the anterior end of the abdomen to the posterior end. Three of these and parts of the fourth and fifth can be seen in dorsal view.

On the cephalothorax there are often much finer bands, which form a figure that GREEN has aptly compared to an hour glass.

This mite has but two pairs of legs and these can easily be made out at the anterior end.

The mite is frequently to be observed to support itself on the apex of its abdomen.

In a slide preparation too, somewhat broad, tapering bristles are seen to be situated at the posterior end.

The younger forms are similar in shape but light in colour; even in the lightest traces of the longitudinal wax bands can be seen.

In all the leaves I have examined I could detect nothing resembling eggs. Perhaps the eggs are not laid on the leaves.

I have seen a bush almost every leaf of which was of a whitish-green colour and heavily dusted with cast skins, yet on the leaves there were very few mites, and these few may have been dead.

I have observed a mite closely resembling *P. carinatus* on a small solanaceous climber (*Solanum venustum*), along with numerous individuals of Tarsonymus translucens.

WATT and MANN give the distribution of this mite as Assam, Darjeeling, Duars and Ceylon.

A. RUTHERFORD.

POULTRY.

UNFERTILE EGGS THE BEST FOR THE MARKET.

Absolutely thousands of pounds worth of South African market eggs are spoiled every summer because they are fertile, and it is the South African farmers and poultry raisers who are losing this sum each year. Egg buyers have discovered by years of experience that they can be sure that one out of every five eggs coming from our country districts is a bad egg, and they fix the price accordingly. So it is the producer who loses, after all.

After the hatching season is over, there is no longer any reasonable excuse for keeping the males with the laying hens. Some people imagine that the hens lay more eggs if the roosters are allowed to run with them. This is a mistake. On the contrary, careful experiments have shown that a flock of hens will actually lay more eggs if the males are not allowed with them.

Because the deterioration which takes place in an egg is not easily visible to the naked eye, as it is in fruits, vegetables, etc., people do not realise the fact that it is one of the most perishable of all food products. This is especially true of the fertile egg. A fertile egg kept in a warm room will become unfit for eating purposes almost as quickly as milk. It is a mistaken idea that a fertile egg has to be in an incubator, or under a hen, in order for the germ to begin to develop. A very large percentage of eggs rejected every summer by the wholesale egg dealers are fertile eggs in which the germ has started to develop, and then died when subjected to a lower temperature, thus causing decay to set in. A fertile egg kept in a warm room or a hot country store, which usually is built of galvanised iron, for even twenty-four hours, will be unfit for food, on account of the growth of the germ.

Unfertile eggs, laid by hens with which no male is running, will keep in good condition for two weeks, or even longer, when subjected to a temperature, which would spoil a fertile egg in twenty-four hours. To illustrate this fact a cake was recently baked at the Missouri Experimental Station, in the making of which unfertile eggs were used, that had been in an incubator for fourteen days, subjected to a temperature of 103 to 104 degrees. The cake was eaten with a relish by a dozen men, who pronounced it first-class in every respect.

When the farmers of our Provinces get to producing unfertile eggs during the summer months they will, as a result, eventually get a much higher price for their eggs. Until they do this, there is not much hope for an improvement in prices.

In conclusion, it may be said that there are five simple rules, which, if carefully observed by our poultry raisers, will increase the selling price of our market eggs to the extent of several thousands a year, and make them

sought after in the tter grade egg markets of our populous centres, instead of being, as they now are, practically shunned by those catering for exclusive markets. These rules are :—

1. Give the hens clean nests and plenty of them.
2. Gather eggs at least once daily (twice daily during hot weather)
3. Keep eggs in a cool place.
4. Market eggs at least twice a week in warm weather.
5. Kill, sell, or confine all mature male birds as soon as the hatching season is over.—South African Poultry Magazine.

UTILITY POULTRY CLUB'S TWELVE MONTHS' LAYING COMPETITION.

The report for the eleventh period of four weeks states that the positions of the three leading pens remain the same as last month. The total number of eggs laid by the leading pen of six White Wyandottes is 1,180, valued at £5. 15*s*. 9*d*. A pen of Buff Rocks still holds the second position.

The report remarks that although the leading positions are held by White Wyandottes, Buff Rocks, and Leghorns, pens of these breeds are also to be found towards the end of the list which gives the order of merit for the hundred pens competing, thus bearing out the theory that egg-production is more a question of "strain" than of breed. The records of the six leading pens to the end of the eleventh period are as follows—

Order.	No. of Pen.	Breed.	Total Eggs for 44 weeks.	Total Money Value.
				£. s. d.
1	60	White Wyandottes	1,180	5·15· 9
2	86	Buff Rocks	1,045	5· 8· $3\frac{1}{2}$
3	32	White Wyandottes	1,099	5· 5· $0\frac{3}{4}$
4	29	,, ,,	1,066	4·17· $0\frac{1}{2}$
5	24	Black Leghorns	973	4·14· $5\frac{1}{2}$
6	45	White Wyandottes	973	4·13·$11\frac{3}{4}$

—Board of Agriculture Journal.

ANIMAL FOODS AS THEY AFFECT EGG-PRODUCTION AND THE HATCHING QUALITIES OF THE EGG.

The Journal of the Board of Agriculture contains the following account which has been summarised from the Ontario Agricultural College Report, 1912 :—

With a view of ascertaining what effect various kinds and quantities of animal food might have on the production and hatching power of eggs, an experiment was commenced in 1909; 125 Buff Orpington pullets were experimented with during the first year, 125 Rhode Island Red hens and

pullets in 1910-11, and 100 Leghorn pullets in 1911-12. The animal food used were: buttermilk, 10 per cent. dry mash beef scrap, beef scrap in hopper, and green cut bone. It was found that butter milk produced the most and the cheapest eggs. Where beef scrap was fed in the hopper the Leghorns and Rhode Island Reds did much better than the Orpingtons. In all cases birds which received no animal food produced the smallest number of eggs, but these eggs had the greatest hatching power. The Leghorns supplied with the ration containing no animal food developed the habit of feather-eating to a great extent, and of the three breeds they appeared to be most in need of this class of food.

POULTRY NOTES.

(*Communicated*).

More than one member has during the last twelve months imported Orpington Ducks. As the laying and table qualities of this breed are supposed to be excellent, would any one who keeps them write and let other members have the benefit of their experience?

This breed was evolved by Messrs. Cook and Sons and was originally a cross between the Indian Runner Duck and the Pekin. This cross gives the excellent laying qualities of the Indian Runner and the table qualities of the Pekin.

Those that have electric light in Ceylon should try Messrs. Cook & Sons' latest system. Experimenting with 600 hens they have found that by lighting up the scratching sheds, thereby making the days longer, the egg production has gone up 30 per cent.; and that young stock reared under these conditions show very much finer growth than others that are reared in the usual way.

Members must remember there will be a show held in January, and that entries must be a record. Now that the matter of our magazine is finally settled the Club may be said to have taken a new lease of life, and it must be everyone's endeavour to make the shows successful.

I regret to report the death of "Rajah." He had no use for the English autumn weather.

May we see Mr. Dias penning a worthy successor.

Pigeons have not been in our shows for some years and it is to be hoped that some interested members will import and fill these classes. Quite useful exhibition or utility pigeons can be purchased for 7/6 to 15/- a pair in England. There do not seem to be many pure bred specimens in Ceylon.

Why should there not be a class for cats as well?

Any contributions to the Magazine will be thankfully received by the Hon. Editing Secretary. His usual experience is that he gets no help but he hopes keen members will assist him.

The following is written by one of our members who takes a keen interest in poultry generally:—

Do fowls in the majority of bungalows get a fair chance? I say *certainly not.* When I visit any bungalow I generally take the opportunity of having a look at the fowls and in most cases how do I find them? Standing about in a miserable sloppy run alternately drawing up their legs to keep their toes warm! A miserable apology of a house and hopelessly overcrowded.

What is the result? No eggs, sickness and continual outbreaks of chicken pox. Fowls suffer from monotony like "master" and to get the most out of them they require as much attention as other stock. They like their surroundings sanitary with plenty of scratching room, and shade from the sun, and shelter from the rains. Keeping a lot of fowls does not necessarily mean plenty of eggs as if the run is too small the fowls do not get a fair chance. Many people have no room to make proper poultry runs, and herd together in a run, that is only fit to hold a pair of rabbits, twenty or thirty miserable fowls who have forgotten the art of walking or scratching owing to scaly legs.

A scratching shed does not cost much money to put up, and if the floor be covered in litter to the depth of a foot or so and the evening feed always sprinkled in the litter, a great improvement in the health and laying of the fowls will be at once noticed. In a limited run this scratching takes the place of exercise. Any litter such as dadap leaves suits very well. It does not take a cooly very long to put clean sand in the sleeping house, say twice a week, and if this be sprinkled with Jeye's all the better.

To get eggs, my advice is—keep the houses clean and, if no proper run, make the birds scratch for their food and kill off the old hens. Do not over feed—a handful of hard food per bird is sufficient, and plenty of green food must be supplied.

The following notes are taken from the FEATHERED WORLD YEAR BOOK from an article written by MR. TOM BARRON under the heading of "Utility Poultry Farming" :—

We hear a lot nowadays about Utility Poultry Farming; so many people seem to think that this branch of farming cannot be made to pay. Far from it. I am convinced after nineteen years of practical Utility Poultry Farming that it is one of the most interesting and remunerative businesses possible if the man at the head of affairs has any knowledge at all of business.

In the first place you require a good laying strain of birds, a strain that has been tested for several generations by trap nest. I do not mean that like always produces like—no, not by any means, but in a great many cases this rule holds good.

Then as to feeding: I have fed my birds for the last five years on corn in the morning, and soft food at night, which is rather reversing the ordinary run of things. Why? Because if you overfeed a flock of birds with a warm mash in the morning, as we used to do, they will hop out in the morning and stand on one leg under the hedge until noon. But if you reverse the feed and have a good scratching shed, and give in the morning a rather light feed of corn, raking all into the litter you will find a different state of affairs—an active hen all the day. We go again at noon with a little more food, and rake well in again and off they go scratching until night. This working is essential to successful utility farming. Then at night, rather early, we do and give a good mash. If we suspect a slight cold we add about 10 drops of Eucalyptus oil to each gallon of water, which generally clears off the cold in due time.

Someone might like to know what breeds I think are the best. In my opinion the White Leghorn and White Wyandotte are the most profitable utility fowls I know. I do not mean that there are not any other good breeds, far from it; but these two I consider are far the best. If you cross White Leghorn and White Wyandotte, then you will have one of the most perfect crosses for eggs I can tell you of.

COHUNE NUTS FROM BRITISH HONDURAS.

The Monthly Bulletin for September contains the following which is a summary of the account appearing in the Bulletin of the Imperial Institute, Vol. XI, No. 2:—

These nuts are the product of the cohune palm (*Attalea cohune*) native of British Honduras, where it occurs over two-fifths of the area. The yield per tree is about 2 cwt., corresponding to some 2,000 nuts.

The kernels which are rich in oil, are not used on a large scale because of their very hard shells. But as machines for breaking them are now being tried, it seems advisable to determine the characters of the product.

The fibrous covering of the fruit contains an oily substance which may be of value when the kernels are worked.

The following figures show the characters of the oil from samples of these nuts received by the Imperial Institute:—

	1	2	3	4
Specific gravity at 15°C	0·870	0·871	0·871	0·868
Acidity ...	3·5	13·1	1·2	20·4
Saponification value	255	256·5	256·5	252·4
Iodine value ...	13·6	13·7	11·4	13·7
Melting point of the fatty acids ...	19·8°	21·0°	20·2°	19·7°

From these figures it is seen that the oil is a good deal like Coconut Oil. The yield of the kernels in fact is about the same as that of copra. Kernels sent to Europe carefully packed and on a commercial scale should fetch about the same price as copra.

DAIRYING.

DISEASES OF THE MAMMARY GLANDS IN THE COW.

The following is an extract of an interesting paper contributed by MR. S. L. D'SILVA to the Journal of the MADRAS AGRICULTURAL STUDENTS' UNION:—

In animals which are used as milk-producing machines, namely, the cows and milch-goats, the diseases of the mammary glands are, as might be expected, of very frequent occurrence. The chief of these are briefly referred to below :—

Imperforate teats ; blind teats :—It sometimes happens that, although the udder is otherwise well formed, one or more teats are found to be imperforate. This condition is discovered only when the animal first calves and begins to be milked. No milk flows from the teat, although the udder is swollen with milk. Examination will show a little membrane closing the extremity of the teat. The membrane should be perforated with the end of a probe or a milk catheter.

Contraction of the sphincter:—Sometimes the teat presents a distinct perforation but the milking is extremely difficult and even impossible. This is often due to the construction of the sphincter of the teat. Treatment is rather difficult. An operation may be necessary, which can be performed only by an experienced hand and which is not always attended with permanent good results. Forcible dilatation is far preferable. This may be effected by frequent passage of probes or siphons of gradually increasing size.

Stritcure of the teat :—Inflammation of the lining membrane of the teat occurring as a complication of mammitis, sometimes results in stricture, that is, narrowing of the canal of the teat. Treat as in "contraction of sphincter."

Sore teats :—This occurs chiefly in the newly calved animals specially in those whose skin is very delicate. The cause is often rough manipulation of the organ by the calf. Ulcers form and assume a very sluggish character. In very bad cases the calf should be removed and fed by hand and the milk drawn off after lubricating the teats with oil. After each milking, dress the ulcers with glycerine of carbolic acid (carbolic acid 1 part, glycerine 12 parts.)

Relaxation of the teat :—This often results from the practice of allowing over-accumulation of milk whereby the sphincter becomes weakened. It gives rise to spontaneous flow of milk (Lactorrhœa). The sphincter in bad cases requires to be replaced by an elastic band, which compresses the teat enough to close the passage but not to strangulate it.

Tumours on the teats :—Little tumours or warty growths are sometimes seen on the teats. They interfere with milking and are liable to injury. They can be easily removed with the knife or by means of ligatures.

Obstructions in the teat :—These are not rare. They are felt as nodules along the course of the duct during milking and the flow of milk is more or less interfered with. They are either masses of curdled milk, or small tumours attached by narrow bases to the mucous membrane or lacteal calculi. These not only impede the free flow of milk but may tend to produce inflammation of the udder and must therefore be removed, if possible. When they cannot be removed, an attempt must be made to return them to the galactophorous sinus where they will often remain without causing inconvenience.

Fistula of the teat ; *milk fistula* :—Any disease or injury to the udder, specially during the period of lactation, may establish an opening between the milk sinus and the side of the teat. The milk, instead of passing through the teat, escapes in a jet at the side. This is a source of loss and is altogether an unpleasant condition. There is further danger of the udder becoming infected and inflamed. It is difficult to cure the fistula during the lactation period as the milk escapes constantly through the injured spot and prevent cicatrization. A teat syphon may be inserted into the teat and kept for some time and the fistula treated according to surgical principles. If this does not succeed, it is necessary to wait until the cow goes dry when, with little attention, the fistula may be readily cured.

Mammitis ; *inflammation of the udder* :—This is due to most diverse causes. Lactation itself is a predisposing cause, as the mammary glands are most active during this period and are therefore most liable to disease, the disease appearing immediately before or soon after calving. Foot-and-mouth disease and cow-pox may cause mammitis. Death of the calf and the difficulty of milking the cow in consequence is also one of the causes. Mechanical injuries may produce inflammation, such as contusions, wounds, injuries in milking and suckling, &c. Among the most frequent causes must be included the imperfect removal of the milk and allowing the animal to remain too long without milking so as to ensure a full and tempting bag at the time of sale. Influence of cold and wet has also been ascribed as a cause of mammitis. There is reason to believe that there is a form of mammitis due to putrid or septic infection.

Mammitis is of the highest importance, not so much as affecting the life of the animal, but as affecting the yield of milk. The disease may be partial or complete. The quarters of the glands are separated from each other by dense fibrous scepta so that there are four glands and one or more may be affected without the rest being involved. The affected gland is swollen, red, hot, painful and hard to the touch. There is generally high fever. The yield of milk is markedly decreased and the milk is curdled and often mixed with blood and pus. Sometimes, when efforts are made to milk the animal, a thin serous fluid is removed. The most favourable termination is what is known as resolution, where the acute symptoms gradually subside and the udder is restored to its original condition. Suppuration is of frequent occurrence and is denoted by stiffness of some part of the gland which pits on pressure. Abscesses form which may

involve a very large part of the gland giving rise to sinuses and fistulæ. In severe and acute cases, gangrene sets in and the affected parts of the glands slough away, the constitution being at the same time greatly disturbed. When the inflammation is less acute, what is called induration sets in, that is, the affected gland becomes hard, the milk secreting cells being blocked up with products of inflammation. In either of these cases, suppuration, gangrene or induration, the quarter is lost. Treatment must include both constitutional and local measures. A purgative dose should be administered and nitre given in drinking water. Milk must be removed at regular intervals, either by milking or by use of the teat syphon or by allowing the calf to suck freely and frequently. The udder must be fomented freely and a poultice applied to it containing belladonna or opium. The udder with the poultice must be supported by a wide bandage passed over the loins. If any abscesses form, they must be opened with a lancet immediately otherwise the pus will burrow extensively and cause sinuses and fistulæ. In case of gangrene, the mortified parts should be excised, the strength of the patient being supported by proper food and stimulant tonics. In cases of induration, alkaline injection must be made through the teats and the udder constantly milked. Stimulating applications such as iodine must be resorted to, so as to induce the absorption of the products of inflammation. Iodide of potassium may be administered internally.

Milk and its disorders: Agalaxia; non-production of milk:—The principal causes of these are previous diseases of the glands such as atrophy or induration. It is sometimes due to the injection of certain plants which check the secretion of milk. Temporary suspension in the secretion may also result as a consequence of the removal of the calf from its mother. In cases of accidents and temporary suspension of milk, change of food is the first thing to be done. Carraway, cumin, ani-seed, coriander and sulphur may be mixed in equal parts and an ounce of the mixture given daily.

Lactorrhœa:—This means constant flow of milk through the teat. See "relaxation of the teat" above.

Hypergalaxia:—By this is meant prolonged lactation. Of course it is by no means a frequent condition but it is sometimes seen in very good milkers. It is hardly a diseased state but it may constitute a great strain on the system. When a cow is within a couple of months of calving and is still in milk, it is advisable to get her to go dry, so that the mammary glands may have rest and the new secretion of milk after calving may not be interfered with.

Changes in the quality of milk:—Some of these are due to excess or deficiency of natural components while others are due to admixture of foreign matters such as blood, pus, specific discharges, bacteria, etc. Some milk gives scarcely any cream, while in other cases the secretion of milk is scanty but very rich in butter.

Bluish watery milk is sometimes given by debilitated animals.

Some milk is known to clot immediately after being drawn from the udder. This is probably due to the action of some fermentation organisms.

Putrid milk is characterized by its smell and is probably the work of some other organisms.

Some milk, some time after it is drawn, is known to become thick and viscous, and to give bad cream. This change is attributed to the action of various micro-organisms.

The milk is sometimes tinted red in consequence of hæmorrhage within the udder itself. If such milk is allowed to remain undisturbed, the blood corpuscles sink and deposit themselves at the bottom of the vessel.

Milk sometimes becomes red some hours after withdrawal. This is probably due to the growth of certain organisms.

The ordinary milk and cream is generally of a yellow colour but sometimes an intense yellow colour has been noticed in milk which is attributed to certain organisms.

Milk is known to turn sometimes bitter, some time after it has been drawn. Certain organisms are supposed to produce this change.

The udder acts very much like the kidney as a natural channel for the elimination of certain principles such as the active principles contained in food and fodder, vegetable alkaloids, drugs of various kinds and poisons like nicotine. This peculiarity explains the influence of changes of diet on the composition of the milk, and the effect of the milk on the consumers. Certain diseases of the cattle are transmissible to man through the medium of milk, particularly tuberculosis, and foot-and-mouth disease.

AGRICULTURAL LITERATURE.

We publish the following list of books likely to be of help to Tropical Agriculturists.

Title of Book.	Publisher's name	Price.
Principles of Agriculture by L. H. BAILEY.	Macmillan & Co., New York.	5s.
Dry Farming: Its Principles and Practice, by WILLIAM MACDONALD.	The Century Co., New York.	5s.
Dry Farming: A System of Agriculture for Countries under a low Rainfall, by JOHN A. WIDTSOE.	Macmillan & Co., New York.	6s. 6d.
Elements of Agriculture: A Textbook, by W. FREAM: revised by Prof. AINSWORTH-DAVIS.	John Murray, London.	5s.
The Agricultural Note-book: Note-book of Agricultural Facts and Figures for Farmers and Farm Students, by P. MCCONNELL.	Crosby Lockwood & Son, London.	5s.
The Fertility of the Land, by ISAAC P. ROBERTS.	Macmillan & Co., New York.	5s. 6d.
Rutherford's Planters' Note Book, by H. K. RUTHERFORD.	Times of Ceylon, Colombo.	Rs. 15. (1£)
The Fermentation of Cacao, by H. H. SMITH.	John Bale, Sons & Danielsson, Ltd. 83-91, Great Titchfield Street, Oxford Street, W.	10s.
Coconuts: Consols of the East, by H. H. SMITH and F. A. G. PAPE.	Tropical Life Publishing Dept. 83-91, Great Titchfield Street, Oxford Street, W.	

GENERAL.

CEYLON AGRICULTURAL SOCIETY.

PROGRESS REPORT, LXIII.

MEMBERSHIP.

Since the last meeting of the Board of Agriculture held on 9th May, 1913, the following members have joined the Society :—

Lolo Gezelsctap, C. W. Smith, J. W. Mackenzie, Nana & Co., Lever Bros., Laboratories de Chimica Agraria, A. F. Soundy, J. M. Kedding, Reading Club, Orde, Java; W. A. Amerasinghe, John A. M. Bond, the Rev. A. G. Fraser, Jules Lionel Marie, Mr. Bullen (London), D. B. Taraporevala, Sons & Co., R. M. John, F. Lindon, T. Johnston, F. Denham Till, A. McG. Forbes, Conservator of Forests, Ashanti, Gold Coast; H. J. Temple, T. Meldon Fitch, W. Wigmore, Bibliotheca Nacional, M. B. Blount, D. L. Pereira de Carmo, Superintendent Choisy Estate, Superintendent Trafalgar, Barber & Pascoe, C. L. Tivy, Reading Club, "S. Bk. M. C." Simbolan Estate, Service de Inspectas Defesa Agricolas, John Macdonald, Mons. le Chef du Service de l'Agriculture de Porto Novos, Director of Agriculture Kampala, Chief Forestry Officer Uganda, James Thin, C. H. Keasberry, J. A. Campbell, A. E. Gay, Dr. Paulo de Quiroz, Bostan Panama Co., A. R. S. Sinclair. S. Sambanther, H. G. Greig, N. Swami Natha Iyer, Nan Ali Koshi Ltd., Gordon Hundley, Manager, Borneo Co., Ltd., C. B. Grey, Malayta Co., St. Ledger B. Aldworth, Major Cecil F. Harrison, Hoofd Administrateur, Java, W. H. Drury, M. S. H. Hebtuabhoy & Co., James Ratnasara, My Kyaw, Gensanshu-Seizosho, Japan, J. A. Vertennes, F. E. Vince, M. Wilson, L. E. Campbell, Estacion Agricola Experimental de San Juan, M. L. M. Mohamed Mohideen, A. C. G. Wijeyekoon, the Mamara Plantations Ltd., R. Sagarajsingam, F. R. Senanayake, J. E. de Zoysa, J. C. H. Seneviratne, Graham Pandithesekera, C. V. M. Pandithesekera, J. E. Corea, James A. de Silva, E. C. de Fonseka, W. M. Rajapakse, F. J. Reiss, F. W Andree, Governor of Ogasawara Islands, G. E. de Silva; Library, College of Hawaii, J. T. de Silva, E. Penn, Abel Fontoura da Costa. J. B. M. Pereria, H. H. M. de S. Ratnakirti, Gerald P. Kelly, J. A. Wattie & Co., Martin de Silva, J. W. Mackey, Dr. W. A. Fernando, J. H. Ameresekera, W. D. A. Fernando, C. P. Harding, W. Davies, The Miller Rubber Co., Mudaliyar Richard de Silva, M. S. Smith, L. E. Knollys, V. N. Prabhoo, J. O. Gray, C. Harvey, A. A. M. Saleem, J. A. Corea, J. A. C. Corea, W. P. Fernando, E. Sans, B. A. Thornhill, Fred. Abayasundara, Agricultural Office of the Potash Syndicate, Bangalore; E. G. A. Palmer, B. A. Kirkham, Dr. Pio. Correa, W. B Lotour, C. F. Tomlinson, D. E. Weerasooriya, Dr. J. S. B. Goonewardene, D. A. P. Ranasinghe, Francis Jayasuriya, Chas. A. M. de Silva,

Gabriel Fernando, D. C. Senanayake, T. K. C. D' Zilva, R. E. S. de Soysa, Nission Rubber Co., Ltd., Boey Yeak Kum, Power & Batty, V. R. Rede, Officiating Conservator of Forests, Rudrappa & Son, F. Crosbie Roles, John Still, H. Amarasuriya, Rev W. T. Garret, A. S. Long-Price, John Tennekoon, P. A. C. Ekneligoda, Godwin de Livera, Dr. G. St. C. VanRooyen, J. D. Walker, J. W. Ekneligoda, and Administrateur Java.

This brings up the total number of subscribers to 1774, consisting of 879 local and 895 foreign subscribers.

The Society is the poorer to-day by the death of one of its Vice-Presidents whose life-long interest in the welfare of this Colony, and particularly in the advancement of its agriculture makes the loss a public calamity. In founding the *Tropical Agriculturist*, Mr. JOHN FERGUSON established a chain that linked up all the agricultural interests of the world, since to-day there is no country which the Journal does not reach. He took a prominent part in the proceedings of the Society from its very inception and it will be remembered that he was mainly responsible for carrying out the idea of the All-Ceylon Exhibition of 1912.

STAFF.

The Agricultural Instructors, after being on special duty in connection with the Co-operative Credit Movement for two months, have reverted to their regular duties. During that period they travelled hard and did much to prepare the way for the work of the Secretary of the Board of Control.

MR. M. J. A. KARUNANAYAKE, Agricultural Instructor, till recently at Puttalam, has been sent to assist MR. N. M. JAYASURIYA, the Instructor of the Southern Province, who has his hands full in connection with trial plots of cotton, maize, castor and fodder grasses in the Hambantota District.

MR. K. CHINNASWAMY PILLAI, a diplomate of the Saidipet Agricultural College and later a Fieldman at Coimbatore College, has been appointed Agricultural Instructor of the Eastern Province with headquarters at Batticaloa. His training and experience should enable this officer to utilize to the best advantage the wide field before him, where natural conditions are very similar to those met with in the plains of the Deccan.

PADDY (RICE).

The disastrous floods of last month which caused so much damage to newly-sown fields have resulted in appeals for assistance in securing seed paddy; and the Society has been doing its best to meet the want. A large consignment of 4 months paddy was despatched to Ratnapura (at the urgent request of the Government Agent, Sabaragamuwa Province) with the assistance of MR. W. MOLEGODE, Agricultural Instructor.

Demonstration paddy plots are being maintained in Kandy and Badulla districts with a view to proving the advantages of planting out single seedlings at regular distances apart. A class of students from Trinity College, at the instance of MR. N. P. CAMPBELL of the college staff, is carryiny on an experiment near Kandy on the same lines with the assistance of MR. MOLEGODE.

As the outcome of the excellent results obtained from Molagu Samba paddy, details of which were given in Progress Report No. LXII., a further consignment of seed had to be indented for from India for the *Maha* season, and this is being cultivated at different centres.

Experiments in the manuring of paddy with artificial fertilisers are in progress at Tissamaharama and Peradeniya. The manure for these has been kindly supplied free by MESSRS. FREUDENBERG & Co.

72 bushels of *Hatiel* paddy raised at the Experiment Station, Peradeniya, (from seed selected by DR. LOCK) is being cultivated during the current season under the supervision of Agricultural Instructors. Anyone wishing to get seed for next Maha sowing should communicate with the Secretary in good time, so that the necessary quantity may be reserved for him. The history of this paddy will be found in the TROPICAL AGRICULTURIST for September, 1911.

The following letter from Mr. V. CASSIPILLAI, Crown Proctor, Jaffna, a large landowner of the North, with reference to the work of the Meston plough introduced by the Society is decidedly encouraging:—"There is no doubt as to the superiority of the Meston ploughs over ordinary native ploughs. Last year I got more than 60 acres of paddy-fields ploughed with Meston ploughs and though there was a general failure of paddy crops in Jaffna owing to the scarcity of rain in the proper time, I found that I realised about 30 bushels of paddy per acre from my lands worked with the Meston against only about 15 bushels per acre from lands ploughed with ordinary native ploughs. I have imported two more Meston ploughs this year and I have got about 80 acres of paddy fields ploughed. I will report the result after February next. I am also using HOWARD'S steel Zig-zag harrow and find that no better implement can be devised for uniformly burying seeds when sown broadcast, especially according to the dry method of sowing.

In the TROPICAL AGRICULTURIST for October will be found the report of the Manager, Experiment Station, Mahailuppalama, on the result of growing paddies from different parts of the Island. These paddies were supplied by the Society, having been collected by MR. N. WICKRAMARATNE, late Agricultural Instructor, who reports that in every case the yields at Mahailuppalama were higher than the average yields in their native habitat. This result is probably attributable as much to careful cultivation as to change of locality.

COCONUTS.

The adulteration of coconut oil by means of groundnut oil, first brought to the notice of the Secretary by one of its members (MR. A. H. DON BASTIAN DE SILVA of Matale), has led to enquiries the results of which go to show that during the first half of the current year, 56,324 gallons of oil, valued at Rs. 82,699 were imported, all consigned to Pettah traders. The Secretary has been in communication with the Low-Country Products Association with reference to the matter, and it is to be hoped now that attention has been called to the existence of the adulteration, it will be made the subject of special investigation by Mercantile firms dealing in oil, and also that means of detecting the adulteration will be discovered.

Specimens of coconuts showing signs of a kernel disease have been received from Negombo district and submitted to the Government Mycologist for investigation.

According to a computation made by a competent authority there are at present about thirty estates yielding a million nuts each per annum, while several others will reach that output in a short time.

A communication received from New York describes a new method of preserving the fresh kernel of the coconut by means of a harmless and tasteless preparation which is said to counteract the acid responsible for bringing about rancidity. The object of this system of treatment is to put in the market a product which would be an improvement on desiccated nut and more suitable for the purposes for which it is employed, and enable the producer to make larger profits. We shall be glad to give the name of our correspondent to any one interested in the matter.

TOBACCO.

The cultivation of tobacco of the Cuban type naturalised in Dumbara is spreading rapidly not only in that district but also in Matale North and Uda-Hewaheta. The establishing of a buying agency at Teldeniya by MESSRS. FREUDENBERG & Co. has given encouragement to the cultivators, who, while disposing of the heavy upper leaves to the Jaffna trader, find a ready sale for the light lower leaves at MESSRS. FREUDENBERG & Co.'s Store. This enterprising firm is curing the leaf on scientific lines for the European market, and also manufacturing an improved type of cigar for local sale. The tobacco station at Teldeniya is well worth a visit just now as the curing of the last season's crop is in progress. A good many Dumbara cultivators are growing tabacco on paddy fields, the produce of which is considered to be, if anything, better than highland leaf.

COTTON AND KAPOK.

The Allen's long staple cotton produced at Ambalantota Experimental Plot was shipped to the British Cotton Growing Association through their local Agents, MESSRS. FREUDENBERG & Co., and a report is expected shortly.

It has been decided to re-sow the plot with cotton this season to ascertain how the land will stand a second crop and to obtain figures as regards cost, yield, &c., for future guidance.

Special facilities for growing cotton have been given to chena cultivators by the Assistant Government Agent, Hambantota, with the approval of Government, and a fairly large extent of land will therefore come under the crop in that district.

At Mediwaka (Upper Dumbara) Cambodia cotton which is doing so well in India has given the best results, and will therefore be grown in the Experiment Garden this season.

A Colombo firm dealing in Silk cotton (Kapok) writes :—"We are prepared to buy kapok seed in any quantity at Rs. 2·50 per cwt. net, delivered free Colombo Railway Station.

"There is practically no difference between kapok and cotton seed and we are paying the same price for both.

"As regards kapok lint, for uncleaned stuff, i.e., the pods with only the outer husk removed, if of good quality and dry, we can give Rs. 9·00 per cwt. net, delivered F. O. R. Colombo.

"We are buying good white well-cleaned (free from seed) kapok lint at Rs. 33·00 per cwt. net delivered free Colombo Railway Station."

FRUITS.

A consignment of 350 grafted fruit plants was received from Bangalore about the middle of October and these were distributed among the members for whom they were ordered.

The fruit garden in Bandaragama has been extended by the addition of a number of new plants, both seedlings and grafts. This garden ought in time to prove of immense importance in extending fruit cultivation in the district.

The Secretary has had good reports of the grafted plants sent to Bandarawela, where the natural conditions approximate to those of Bangalore from where the plants come.

The Director of Agriculture, Manila, in sending 5 seeds of the Pahuta Mango writes :—"This is a very high-flavoured mango with a comparatively large seed; the colour of the skin never assumes the bright yellow tint of the Pico and Carabao varieties."

The Chief of the Division of the Horticulture, Philippine Islands, has sent a few seeds of (1) *Parkia timoriana*, described as a large ornamental tree, the pods of which are relished by native cattle and the seeds (15 to 20 in each pod) roasted and used like coffee by the Filipinos; (2) a vigorous variety of Rosella (*Hibiscus sabdariffa*.)

MR. P. J. WESTER, Horticulturist, Lamao Experiment Station, has kindly sent out a few seeds of *Artocarpus ordoratissima* which he describes as the best-flavoured of all *Artocarpus* fruits. He adds that it is most remarkable how such an excellent fruit has escaped dissemination. It is said to succeed under conditions favourable to the mangosteen, and this perhaps may account for its localisation.

The disease affecting plantain trees is having MR. PETCH'S attention. A leaflet on the subject is about to be issued.

VEGETABLES.

The raising of onions from seed in the Ratnapura district has given very encouraging results. While the yield of crop is not noticeably larger, the improvement in the quality and size of bulbs raised from seed is striking. There is the further advantage that growing from seed is more economical for while seed required for planting an acre costs less than Rs. 15·00 the value of seed bulbs for a similar extent is about Rs. 150·00. The Agricultural Instructor is giving special attention to the extension of onion cultivation in the district, while the trial plots in School Gardens are helping to practically demonstrate the advantages of propagation by seed. The Society has already published a leaflet on onion cultivation, but a second leaflet dealing especially with cultivation by seed and giving comparative yields will be issued at an early date. When a local supply is available the cost of seed will probaby be less, but at present the method of inducing seed-production is not known. The information given below should, therefore, prove useful to members:—Select well developed bulbs and before planting cut them in two with a knife, the upper part (about a fourth of the bulb) being removed. Then plant the "butt" ends six inches apart in beds which have been well-tilled and liberally manured. It will be found that several flower heads will spring up from each bulb and ripen seed.

1,470 packets of English vegetable seeds and about two hundred of Indian and local varieties were distributed last month for the season's planting.

REPORTS AND INVESTIGATIONS.

Reporting on samples of bleached sections of palmyrah leaves forwarded to the Imperial Institute by the Secretary, the Director says:—"The specimens are interesting, and if the material does not become discoloured on continual exposure to light it could doubtless be used locally for museum labels, etc., as you suggest. Attempts were made some years ago to find a market for palmyrah leaves in the United Kingdom, but without success. The leaves might be used for paper-making, but their bulky nature and the consequent high cost of transport would render their importation unremunerative. It is, however, possible that they could be used for paper-making in Ceylon, or be converted into 'halfstuff' and exported in the latter form."

The Government Agricultural Chemist reports as follows on the feeding value of rubber seed poonac or cake:—"The nutritive ratio of above calculated from the analysis sent is 1: 3·5, and should prove useful as a feeding stuff for horses, cattle and poultry. The quantity given should be in small, but increasing quantities to study the effects on the animals and to see how they take to it.

Apparently the analysis is made on a decorticated sample, and it would be advisable to make it always from decorticated seed, as the seed coat is hard, and the fracture sharp and might prove an irritant if taken internally." The analysis sent was as follows: Moisture 11·52, oil 6·08, albuminoids 13·51, carbohydrates 31·97, indigestible fibre 35·54, mineral matter 2·58.

In September last the Agricultural Instructor in charge reported trouble among the orange trees at Bandaragama garden describing it thus:—"The leaves on the tender shoots turn yellow and fall off, the shoots too subsequently dying back to the joint with the main stem." The leaves were also found to be attacked by a night fly. Reporting on this the Government Entomologist says that he does not attribute the trouble to the fly which he identifies as *Apogonia*—probably of the species *Comosa*. He mentions that the Government Mycologist thinks the trouble may be in the root. Against the fly he suggests a spray made up of $\frac{1}{4}$ lb. Paris green and 50 gallons water with $\frac{1}{4}$ lb. freshly slaked lime.

The Government Entomologist reporting on an insect pest on cotton grown at Hettipola identifies it as Black Scale (*Saissetia nigra*) and advises Kerosene emulsion spray made thus: soap 1 lb., soft water 2 gallons, kerosene 4 gallons. Dissolve the soap in boiling water, remove from fire, add the kerosene at once and thoroughly agitate mixture until a creamy solution is obtained. Add 14 gallons water before spraying.

The Government Agricultural Chemist has kindly furnished a report on a sample of vinegar made from Cane juice at Nagoda Estate, the property of MR. M. A. JAYASINGHE, the only local sugar manufacturer. The details of analysis are given below:—Total quantity measured 550 c. c.=0·968 pint., Specific Gravity 1021 @ 84 F. Solids 5·0%, Total Ash 0·25%; Ash soluble in water 0·10%; Ash insoluble in water 0·15 per cent; Dextrose 2·85 per cent; Alaklinity as Sodium Carbonate 0·04 per cent; Acetic acid 2·86 per cent; Total fungi after drying weighed 0·68 gms. 0·12 per cent. It will be seen

from the analysis that fermentation has not gone far enough, and apparently the vinegar has been made by the slow process. It would be better to use the "Generator" process by allowing the fermentable liquid to pass slowly through a barrel provided with a perforated false bottom, and packed with beech-wood shavings which have been previously saturated with old vinegar, and a current of air being passed up through them; this will give a much larger surface and permit the acetic ferment freer action. The process only requires 2 or 3 days for acetification. At present the sugar can be tasted through the acid.

A parcel of *Cordia Myxa* fruit (the Sebestens of old writers) locally known as "Lolu" has been forwarded to the Imperial Institute for examination and report. Apart from their value as a drug the fruits contain a strong adhesive.

The following is a summary of a report (dated 20th March last) made by the Director of the Imperial Institute on a sample of Kumbuk (*Terminalia glabra*) bark forwarded by the Secretary:—"Trials carried out for the Institute by a tanning expert have shown that this bark offers certain drawbacks which would make it hard for it to compete with the rich tanning materials available. An independent trial made by a firm of light leather tanners showed that the leather tanned by it was too dark in colour to be acceptable under present conditions. On the whole it does not seem likely that the bark of *Terminalia glabra* could be profitably exported to the United Kingdom, though it could be employed in Ceylon in preparing leather either for local use or export."

Reporting on a deposit often found in the hollow of the Bamboo culm and locally known as "Una Kapuru" (Bamboo Camphor) the Government Analyst says: "The substance consists mostly of silica with a trace of iron and phosphate."

With a view to eliciting more definite information about the properties of the Alkaloid *Arakene* found in the leaves of the Betel Vine (*Piper Betel*) a supply of leaves was forwarded to the Government Agricultural Chemist who is working on them. So far as known the salts of Arakene possess properties similar to those of Cocaine, and SIR GEORGE WATT has expressed the opinion that valuable results are likely to follow further investigation into therapeutics of betel leaves. The efficacy of the leaves, and of the oil extracted from them, as employed in native medicine, goes to support this view.

INTRODUCTIONS.

Sorghum for fodder (which is the subject of the Society's leaflet No. XLVI) is being tried at various centres, the seed being of Indian varieties secured through the Madras Agricultural Department.

At Tissamaharama five plots of new fodder crops have been laid down with a view to deciding which variety would prove the most suitable for the locality.

Seed of *Acacia pycnantha* (Golden wattle) considered to be less susceptible than *A. decurrens* to the "fire blight" disease, have been imported at the request of a correspondent.

Acacia dabshiaca, introduced from Egypt, has been established at the Stock Garden and in Peradeniya.

Carum copticum, seeds of which were procured from India, is being successfully cultivated at the Balangoda garden.

Artiplex hortensis (Mountain spinach) first grown in School Gardens, is coming to be as well established in the Kandy district as Chinese cabbage was last year.

Another lot of *Algaroba* bean seed from Hawaii was received for trial in likely localities. A note on this bean, accompanied by an illustration, will be found in the TROPICAL AGRICULTURIST for September last.

Four new varieties of *Yams* introduced from the Gold Coast are doing well at the Government Stock Garden.

The latest report of the *Date-palm* suckers imported from Egypt and distributed through the dry districts is to the effect that 3 in Batticaloa, 6 in Jaffna, 2 in Puttalam, 4 in Kalpentyn and 5 in Hambantota are doing well.

DR. DAVID FAIRCHILD has kindly forwarded a packet of *Cassia Bearana* obtained from Inhambano, East Africa, through MR. KEYS, Superintendent of the Methodist Mission, Limpopo District. This species of Cassia has a high reputation as a cure for malarial fever.

MISCELLANEOUS.

Definite arrangements have been made for Shows to be held next year at Nuwara Eliya and Matara. Shows are also likely to be held at Tangalle and Batticaloa.

A large number of enquiries have been received with reference to Kurakkan as a food for estate coolies and the sources of supply. Applications have also been received for seeds for sowing. The demand for this grain for feeding Tamil labourers has raised the price about double the normal rate.

A note on the progress made with lac culture up to the present time will be found in the TROPICAL AGRICULTURIST for October from which it will be seen that the results are, so far, encouraging.

A report on the quality and value of samples submitted to the Imperial Institute is being awaited.

In conclusion I would offer a cordial welcome to HIS EXCELLENCY SIR ROBERT CHALMERS as our new President and express the hope that the work of this Society will flourish under his wise rule.

C. DRIEBERG,
Secretary, C. A. S.

3rd November, 1913.

CEYLON AGRICULTURAL SOCIETY.

MINUTES OF MEETING OF THE BOARD OF AGRICULTURE:

MONDAY, 3RD NOVEMBER, 1913.

Minutes of a meeting of the Board of Agriculture held at the Council Chamber at 12 noon on Monday the 3rd November, 1913.

HIS EXCELLENCY THE GOVERNOR presided.

There were also present:—The Hon. the Colonial Secretary, the Hon. the Colonial Treasurer, Sir Solomon Dias Bandaranaike, the Hon. Sir S. C. Obeyesekere, Hon. Mr. Van Cuylenburg, Hon. Mr. T. B. L. Moonemalle, Hon. Mr. Abdul Rahiman, Hon. Mr. A. J. R. De Soysa, the Hon. the Government Agent, W. P., Director of Agriculture, Government Agricultural Chemist, Govt. Botanist and Mycologist, Superintendent Botanic Gardens, Managers Experiment Stations, Gannoruwa and Mahailuppalama, Govt. Veterinary Surgeon, Conservator of Forests, Dunuwile Dissawe, Dr. H. M. Fernando, Messrs. Francis Beven, A. W. Beven, J. Tennekon, R. M., A. E. Rajapakse Mudaliyar, Tudor Rajapakse Mudaliyar, F. M. Mackwood, A. N. Galbraith, M. Stevenson, A. Bruce, H. Amarasuriya, L. W. A. de Soysa, W. A. de Silva, K. B. Beddewela, H. L. De Mel, A. V. Atapattu Mudaliyar, S. Weerackkody Mudaliyar, James Peiris, Dr. Joseph Pearson, J. E. R. Pereira, N. J. Martin and C. Drieberg (Sec).

The HON. the COLONIAL SECRETARY read an Address of Welcome to His Excellency, who replied.

The Minutes of the previous meeting held on May 9th, 1913, were read and confirmed.

The Progress Report, previously circulated, was taken as read. The Secretary submitted memorandum by MR. BRUCE in which he stated that it was possible to detect the oil adulteration of coconut oil with groundnut oil.

Statement of Expenditure to end of October was laid on the table.

Mr. FRANCIS BEVEN proposed the following resolution:—"That the Ceylon Agricultural Board desires to place on record its appreciation of the valuable services rendered by the late MR. JOHN FERGUSON as a member since the establishment of the Society: its sense of the loss which the cause of Agriculture and every good work in the Island has sustained by his lamented death, and its sympathy with the members of his family in their grievous bereavement."

The DIRECTOR of AGRICULTURE seconded, and the members signified their approval by standing up.

MR. LYNE announced that he had received a letter from PROF. DUNSTAN enquiring whether the Ceylon Government wished his scheme to be considered by the London Committee and, if so, suggesting that a cable advice be sent. On the motion of MR. MOONAMALLE seconded by MR. JAMES PEIRIS the following resolution was adopted:—"That the Board of Agriculture desires the views of the London Committee on MR. LYNE's proposals for a College of Tropical Agriculture in Ceylon."

The meeting of the Society followed immediately after, when MR. A. W. BEVEN read an interesting paper on DRY FARMING. MUDALIYAR WEERACKKODY, the Director of Agriculture, the HONOURABLE MR. FREEMAN and MR. JAMES PEIRIS offered remarks, after which His Excellency summed up the discussion and thanked MR. BEVEN for his interesting paper.

C. DRIEBERG.
Secretary, C.A.S.

THE ADDRESS OF WELCOME.

The Hon. Mr. R. E. STUBBS, Vice-President of the Board, read the following address of welcome from the Board of Agriculture to H. E. SIR ROBERT CHALMERS, the new Governor of Ceylon :—

To His Excellency SIR ROBERT CHALMERS, K C.B., Governor and Commander-in-Chief, Ceylon.

Your Excellency,—On behalf of the members of the Ceylon Agricultural Society founded by SIR HENRY BLAKE and fostered by SIR HENRY MCCALLUM, two of your distinguished predecessors, we extend to Your Excellency a hearty welcome to Ceylon in the assurance that the great industry which we represent will continue to advance under your rule.

Sgd. R. E. STUBBS, Vice-President; R. N. LYNE, Organising Vice-President; S. C. OBEYESEKERE, Low-country Sinhalese Member in Council; A. KANAGASABAI, Tamil Member in Council; Wm. DUNUWILLE, Dissawe; C. DRIEBERG, Secretary, C.A.S.

HIS EXCELLENCY'S REPLY.

MR. STUBBS AND GENTLEMEN,

It is a very great pleasure to me to be present here to-day and to receive the kindly words with which you, MR. STUBBS, have addressed me on behalf of the Society and the Board of Agriculture. It is a great pleasure to me because as I told you in the last words I think I used in this room, I regard agriculture as necessarily, so far as human eye can see, the main industry of the Island. Anything therefore that can conduce to the principles and development of agriculture in this Island must commend itself in an exceptional degree to the one who is the Governor of the Colony (Hear, hear). My interest in agriculture is two-fold. Anything that can extend the principles and science of agriculture must be perhaps the most prominent interest that Ceylon can look forward to, but personally I take an interest in the diffusion of those principles which ought to be formulated by men of science and practical men. I regard everything as depending on the personal interest taken in that diffusion among the cultivators of to-day and among the cultivators of to-morrow of all that can be done by science for the extension of the principles that cultivators of to-day and to-morrow can enjoy in the extension of this great main industry throughout the masses of the permanent population of the island. I think I am rightly informed when I say there are present here to-day some of the Agricultural Instructors who are the medium of diffusion among the cultivators of Ceylon of the knowledge of what may be known or is known to you who are experts, but not to them whose industry depends on the successful application of that knowledge. I am very glad the labours of the Agricultural Instructors—as far as I am in a position to know from information which reaches me—have been attended with marked and increasing success. Let us all hope that these missionaries of agriculture will be increasingly successful as time goes on. There is another branch on which I have to touch to-day and one which is of peculiar interest to me, and that is our future village cultivators. I hope we may be able to reach them throughout the Island in the schools, so that the future generation may start their agricultural life with a fuller knowledge than was given to the generation before them. I thank you.

PADDY AND CO-OPERATIVE CREDIT SOCIETIES.

DEAR SIR,

I wish to say a word in reply to MR. E. ELLIOTT's contention in the November issue of the TROPICAL AGRICULTURIST (p 394). He states that there is less advantage to the cultivator in borrowing from a Co-operative Credit Society than in the usual way.

In MR. ELLIOTT's comparative statement to show the advantages of the ordinary system of borrowing, he omits to give a value to the 1 bushel borrowed according to the native plan, while he puts down Rs. 2/- as the value of the bushel borrowed from a Co-operative Credit Society. Had he given the same value to the bushel in the former as in the latter case, it would show that the lender was the loser of 50 cents which is hardly likely ! The calculation as given by MR. ELLIOTT will have to be revised.

I would now state the case for the Co-operative Credit Society as follows :—Suppose a man borrows, from a Society, a bushel when it is worth Rs. 2/-. If he borrows in the usual way he would have to return $1\frac{1}{2}$ bushels at harvest time, but under the new condition he could keep his $1\frac{1}{2}$ bushels of paddy till the price rises to Rs. 2/- per bushel and then sell it for Rs. 3/-. This he cannot do under existing circumstances as the loan has to be settled at harvest time.

Now, the debt of Rs. 2/- to the Co-operative Credit Society could be liquidated after 6 months by a payment of Rs. 2·12, so the borrower would be a gainer by the difference between Rs. 3/- and Rs. 2·12 or 88 cents, i.e., 30 cents more than by MR. ELLIOTT's showing—if his figures can be accepted.

Yours truly,

N. WICKRAMARATNE.

THE LAWES AND GILBERT CENTENARY.

The year 1814 saw the birth of the late SIR JOHN LAWES, and 1817 was the year of birth of the late SIR HENRY GILBERT. These two dates are so important in the history of horticulture and agriculture that arrangements are being made to organise a centenary fund by which an appropriate memorial may be set up.

Every cultivator of the soil has heard of Rothamsted, and many hundreds have visited the experimental plots and seen something of the work that has been done there. Very many more, however, are unconsciously utilising the results of the labours of the Rothamsted investigators, and are getting better crops at less expense than could have been obtained had the Rothamsted Experimental Station never existed.

When SIR JOHN LAWES came into the Rothamsted Estate at the age of 19 years agriculture was still rather in the depressed state into which it fell after the Napoleonic wars. Some of the large landowners were taking a serious view of their responsibilities, but many others were careless and

negligent, and there would have been nothing unusual in the circumstance had Sir John taken to the easy-going life of the English country gentleman. But he did not; instead, he began to make experiments, and in doing this he went further than such of his predecessors and contemporaries who were also experimenting, for he realised that two men are better than one at the business. He found as colleague a young chemist, Joseph Henry Gilbert, who after studying under Thomson, Graham and Liebig, had turned to calico printing near Manchester. The two men were particularly well fitted for each other; Lawes had a thorough practical knowledge of farming, while Gilbert had a thorough knowledge of Chemistry; Lawes was a quick thinker given to generalising, and Gilbert was a most careful and painstaking investigator who always insisted on ample proof before he accepted anything, and compiled abundant evidence in proof of the statements he made. Thus right at the outset the work represented that combination which is rightly looked upon as necessary for horticultural and agricultural experiments; a combination of practice with science. Landowners before Lawes had made experiments, and chemists before Gilbert had attacked agricultural problems. But no one before or since has done quite so much as these two investigators, because no man could have the combination of qualities they jointly possessed.

The first big problem they studied was: what are the substances that plants feed upon, and how may the farmer increase the supply of them in the soil? Liebig had done much to clear up the problem from the theoretical side, but the practical problem remained largely unsolved. Lawes and Gilbert therefore set out field experiments to study the requirements of the four members of the old Norfolk rotation: Wheat, Barley, Clover and Swedes, to which they later added Grass, Oats, Potatoes, Sugar Beets and Mangolds. Lawes had already found that bones, so useful on other lands, were ineffective on his own, and he traced this lack of action to the insolubility of the phosphates. When the bone was treated with sulphuric acid it proved very active. Lawes understood chemistry sufficiently to know that calcium phosphate from any other source after treatment with acid would give the same result, and so he was led to the discovery of superphosphate, a valuable manure made out of two substances of less direct value to the farmer, namely, sulphuric acid and insoluble rock phosphate, both of which can be obtained in practically inexhaustible amounts.

They soon found that all crops excepting clover must have a sufficient supply of nitrogenous food or they will not grow.

But nitrogenous manures alone would not give satisfactory results. Complete success was only obtained when phosphates and potash salts were applied in addition. Some crops wanted more of one than of others: Barley and Swedes wanted more phosphate; Mangolds and Clover wanted more potash; but each crop needed all these constituents in some proportion or other. When these are provided the nitrogen supply becomes the determining factor in regulating the size of the crop: as the nitrogen supply is increased so the crop is increased, so that a grower can get any sized crop he wants up to a certain point by increasing the nitrogen supply. The limit is only set when the selling value of the crop is below the cost of manure and cultivation. The best nitrogenous and other fertilisers, and the best ways of using them, were all carefully investigated.

It was also found that the crop did not take up anything like all the nitrogen supplied in the manure; there was considerable loss. In view of the great cost of these manures it became necessary to discover how the losses arose. A very ingenious field experiment showed that a winter's rain would wash out from a piece of fallow land as much nitrogen as would give a four-quarter crop of wheat. The discovery was followed by further investigations which led to much useful work on drainage water. Another source of loss was also discovered which is now being further studied.

The development of these experiments led to a complete study of the effect of manures on crops, and the general relationships existing between the soil and the plant. Many of the results of the labours of Lawes and Gilbert have passed into common horticultural and agricultural practice; they have been summarised in a convenient form in the books on soils and manures that have been published from Rothamsted during the past seven years.

Every horticulturist knows that there is no such thing as finality, either in science or in practice. If any sceptic thought there was he would only have to go for two years in succession to the horticultural exhibitions to see the advances made even in a single season. It is especially true of the science of the soil and of plant nutrition—the subject particularly associated with Rothamsted—that the pioneering work so ably done by Lawes and Gilbert has to be followed up. Fortunately an enthusiastic body of investigators are uniting at Rothamsted to carry on this work, and in order to facilitate their researches it has been decided to build a commemoration laboratory, adequately equipped and affording the necessary accommodation for future developments. For this purpose £12,000 is required, but if half this sum is raised by subscription the other half will, it is anticipated, be provided by a grant. Thus, £6,000 is asked for from the public, and of this it is hoped that £1,500 will be raised in subscriptions from growers. Rothamsted has supplied the model on which agricultural experimental stations all the world over have been formed. No better memorial to the genius of the founders of Rothamsted could be made than the addition of a commemoration laboratory to this historic station.—GARDENERS' CHRONICLE.

CARBON BISULPHIDE AS AN INSECTICIDE.

Carbon bisulphide is an insecticide which deserves to be better known and more easily obtainable in Ceylon than it is. The writer is informed that it can be imported into Ceylon by anyone without payment of duty. The chief trouble, however, is that shipping Companies object to carrying it owing to its inflammable character, and usually carry it as deck cargo at owners' risk.

It is extensively used in the United States of America and in France; in the latter country against the grape Phylloxera, which lives on the roots of the vines.

In the United States of America exhaustive enquiries have been made into its properties, and the writer is indebted to various bulletins of the American Bureau of Entomology for much of the information which follows.

The liquid which, when pure, is of a colourless, watery appearance is one-fourth heavier than water, and evaporates rapidly on exposure to the atmosphere ; the evaporation may be entirely prevented by covering the surface with a layer of water.

If pure the liquid is completely volatile and will not stain even the finest fabrics, nor will it impair the edibility of foodstuffs even if poured upon them.

The ordinary commercial article, however, is more or less impure and has a yellowish tinge as well as an obnoxious odour ; the impurities, however, increase its insecticidal value.

The liquid is not at all explosive, so that there need be no fear of handling it if the can or bottle in which it is contained is perfectly tight.

The vapour is fully two and a half times as heavy as air, and consequently settles downwards ; this property has an important bearing on the method of application of the bisulphide.

The vapour when mixed with three times its volume of oxygen or an amount of air containing this amount of oxygen forms a mixture which is very highly explosive on ignition. The vapour is also strongly suffocating and poisonous, and should not be inhaled.

But these properties need not deter one from its use. It is extensively used in the arts, and this fact shews that it is not an unusually dangerous thing to handle, and only requires knowledge of its properties and care in its use.

In most cases there is no need for the operator to be unduly exposed to the fumes and in cases where he must needs be for a time, as in fumigating warehouses, etc., he will usually be warned it is time to seek the fresh air by a feeling of dizziness.

As an insecticide Carbon bisulphide is of great use against those injurious insects which cannot be killed by poisoning their food, nor by spraying them with a contact insecticide.

It is applicable only where its vapour can be fairly well confined.

Within these limits it has a wide range of usefulness, e.g., against insects in the soil, as cockchafer, wireworm, aphis, eelworm, mole-crickets, root-maggots ; against ants and termites ; against borers, as red-weevil and coffee borer or red borer ; against insects infesting stored products, as rice-weevil, cigarette-beetle, wax-moth, clothes' moth, museum pests ; against insects infesting such nursery stock as can be placed conveniently in a tightly fitting box or infesting such plants as can be covered where they grow by an airtight receptacle, as, for example, low-growing gourd-vines infested with aphis.

Other occasions on which it might be used will occur to everyone.

In tightly enclosed spaces it is usually employed at the rate of 1 lb. of the liquid to 1,000 cubic feet of space to be treated. Where it is impossible to obtain such conditions the dosage requires to be increased say to 2 lb. to 1,000 cubic feet.

Against ants and termites 1 to 2 ounces (4 to 8 teaspoonfuls) should be applied to each of several holes, the number of holes depending on the size of the nest.

Against insects in the soil the amount of carbon bisulphide to be employed and the method of its application will vary with the particular insect and the nature of the soil, whether sandy or clayey, wet or dry.

In general, holes should be made from 12 to 16 inches deep, 1 to 1½ feet apart, and into each hole from ½ to 1 ounce of the liquid should be poured.

The liquid must not be allowed to come into contact with the roots of plants.

The vapour must be prevented from escaping into the air by covering the holes with earth or with a wet blanket.

Against insects infesting grain and other stored products 2 lb. to 1 ton or 100 bushels of grain should be allowed, and the bins or barrels should be kept closed for from 24 to 36 hours.

The liquid should be placed in a saucer or other vessel on the top of the grain.

It has been found that the germination capacity of the seeds of the following plants is affected injuriously by exposure to fumes of carbon bisulphide at the above strength—cabbage, barley, rye, wheat, maize, rice, millet, crimson clover.

Carbon bisulphide is put up in cans or iron drums holding from 1 to 50 lb. In the United States of America it costs in 50 pound drums 10c (30c Ceylon) per lb. or even less.

D. WALDIE & Co., Chemical Works, Konnagar, Calcutta, quote Rs. 1-4-0 per lb. f. o. b. Calcutta for minimum quantities of 16 lb.

BAIRD and TATLOCK, London, list it at 8*d* per lb. or W. Qt. 6*d* per lb. W. Qt. = 7 lb.

A. R.

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TARRING PRUNING CUTS ON TEA.

That large cuts on tea branches should be tarred appears self evident to a plant pathologist. Decay often sets in from such cuts, especially on the older branches, with the ultimate formation of large open wounds,—"cankers"—down the stem; and there is at least one stem disease in up-country districts which owes its existence to "collar pruning," or pruning low down on the main stem, and neglecting to tar the exposed wood. But almost every tea estate can furnish examples of extensive "branch cankers," which are no more to be attributed to the action of a specific disease than is the decay of a fence post. Such cases can be prevented by tarring the cuts.

It has frequently been pointed out in these columns and in circulars dealing with plant diseases that the tar to be used for protecting wounds and pruning cuts is ordinary coal tar. That advice has run counter to general opinion, for in Ceylon there has been an unaccountable preference for Stockholm tar. How this preference originated is not ascertainable; it can only be suggested that it has been thought that as Stockholm tar is a vegetable tar it must be the best to apply to plants. Experiments on this point have recently been carried out by Dr. C. Bernard and Dr. J. J. B. Deuss, of the Experiment Station for Tea, Java, and their results, from Mededeelingen voor het Proefstation voor Thee, No. XXV, are summarised below.

Nine experiments were instituted, the following substances being used in the different experiments.—

(1) Coal tar, which was said to "burn" the branches.
(2) Stockholm tar.
(3) Coal tar, direct from the Buitenzorg gas works.
(4) Crude carbolic acid.
(5) Schacht's Obstbaum carbolineum, "soluble" (i. e. emulsifiable.)
(6) Carbolineum avenarium, emulsifiable.
(7) Carbolineum from the Pomologische Vereeniging, emulsifiable.
(8) Cheap Carbolineum (Lindeteves), not emulsifiable.
(9) Xylam: a Carbolineum preparation from Fleisheim, not emulsifiable

The substances 5 to 8 were more or less brown in colour, and more liquid than tar. No. 9 resembles ordinary black tar in appearance and consistency.

Old bushes were treated with these nine preservatives immediately after pruning. Some young plants were treated with Nos. 1, 2 and 3 immediately after pruning, others with 3, 2 and 9, twenty-four hours after pruning, and others with No. 3 about twenty days from pruning. All the liquids were used without any addition of water.

Substances 1, 2, 3 and 9 form a permanent layer which closes the wound. Nos. 4, 5, 6, 7 and 8, penetrate immediately into the tissues and dry on the wound without forming a protective layer.

The plants were examined one week, three weeks, and six weeks, after the application of the preservatives.

COAL TAR.

Leaves which came in contact with the tar were only slightly burnt. The buds developed even when the tar covered the point of origin of the bud. On branches of the current year the tar penetrated to some extent, especially between the wood and the loosened bark, but there was no burning to speak of, not even on the cuts on very young branches.

The wound was well protected by the layer of tar. If the pruning had been badly done, and the surface was irregular or split, the tar penetrated further, as it did also if the cuts were tarred immediately after pruning, before they were dry.

On branches of the previous year, or older, the tar scarcely penetrated at all : even on damp or irregular cuts, the penetration was almost nil. And it is these branches which should be tarred : the younger branches easily form a callus. Tarring is best done twenty-four hours after pruning as the wounds have then dried, and there is then less danger of penetration.

Examination of the cuts six weeks afterwards showed the healing had begun below the part to which the tar had penetrated. There had thus been some burning of the living tissue, but it was of quite minor importance in comparison with the advantages of closing the wound and preventing the attacks of white ants. The tarred cuts developed a slight mouldiness, but much less than the untarred.

The results with this tar, which had been said to be of the worst description, speak most favourably for its use. One cannot say that it causes serious burning of the tissues of the plant. This tar was also said to cause wounds on the hands of the coolies, but that was found not to be the case, and it is pointed out that the coolies at the gas works handle tar without injury. If wounds are produced on the coolies' hands in the fields, that may possibly be due to a concentration of the sun's rays by the patches of tar, and in that case it can be prevented by rubbing the patch with soil.

STOCKHOLM TAR.

This "burnt" the leaves more than coal tar, but the injury was still only small. If a drop of tar fell on a leaf stalk, it did not cause the leaf to fall. As far as regards the penetration of this tar, all the observations recorded in the case of coal tar are applicable in this case *but always in a greater degree*. On branches of the current year the tar penetrated to a depth of from two to three millimetres into the wood, and further into the pith. On branches of the previous year the penetration was less, especially if the wound was dry, but it was greater than in the case of coal tar. In general, this tar is not so good as coal tar for the present purpose. Instead of forming a shining

black, weather-resisting layer over the wound, it leaves a rough surface incompletely protected, and moulds develop more freely on it. The growth of callus is slower than on untarred cuts.

BUITENZORG COAL TAR.

This was the ordinary tar of the gas works, not treated in any way. The results were the same as with No. 1. The growth of callus (wound-healing tissue) on the tarred cuts was more rapid than on the untarred. Branches not treated were attacked by white ants after six weeks, while the tarred cuts were not touched.

CRUDE CARBOLIC AND VARIOUS CARBOLINEUMS.

These are not suitable for the present purpose. They penetrate deeply into the tissues and do not form a protective layer. They cause strong burning between the wood and the bark, which is the region whence the callus arises; consequently the growth of the callus is slow and begins so far below the cut that the wound is not healed over. Untreated cuts healed better than those treated with these substances. Leaves which happened to come in contact with these materials were more or less damaged and some of them withered and fell off. These disadvantages do not occur to the same extent with all these materials, but they are all to be avoided if the object is to protect the cut.

XYLAM.

This resembles a simple black tar, with scarcely any modification of any importance, and the observations already quoted with reference to coal tar apply equally to it.

SUMMARY.

It is advantageous to tar pruning cuts, but the pruning should be done properly so that no splitting occurs, and saw cuts should be finished off with the knife. It is not necessary to tar cuts on branches of the current year, but on branches a year old or more they ought to be tarred.

Tarring twenty-four hours after pruning appears to be the best, if the wounds are to some extent dry. This is not of great importance in the case of old branches, the flow of sap from which is small.

Ordinary black tar, as it comes from the gas works, should be used, unmixed with any other substance. It should be used as thick as possible. Any water found on the surface of the tar should be removed before using, as any injurious substances in the tar concentrate in it.

It is intended to continue observations on the treated and untreated cuts and to publish further details.

T. PETCH.

THE PRESERVATION OF COLOUR IN PLANT PREPARATIONS.

Various methods are in use for the preservation of the natural colours of plants, but so far as our experience goes none of these methods is uniformly successful. In many cases the colour of leaf and flower may be preserved in plants which have been dried carefully and at not too high temperatures. The method which is commonly employed is to cover the specimen with sawdust (of some hard wood) and to put it in a drying oven. A drawback to the process lies in the fact that the dried specimens are extremely brittle. It is possible that if the dried preparations were transferred to formalin or to the mixture to which reference is about to be made this drawback might be overcome. The newest method, which is advocated by MR. H. M. QUANJER (see *Bot. Cent. blatt*, No. 39, 1913) consists in placing the specimen in a mixture of 3 grams copper sulphate, 200 c.c.m. of formalin, and 1½ litres of water. The specimen is left for some time—until it is thoroughly penetrated by the solution—and then is transferred to a solution of formalin, presumably of from 2 to 5 per cent. MR. QUANJER states that this process gives excellent results with pathological specimens. In certain cases the blackening of tissues must be prevented, and this may be effected by a preliminary treatment, for about three minutes, with boiling water.—GARDENERS' CHRONICLE.

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"DRY FARMING"

(*In continuation*)

The Editor, Tropical Agriculturist, Peradeniya.

I write this memorandum in the hope of correcting some apparent misunderstanding regarding the paper on "dry farming" presented at the last meeting of the Society.

The paper begins with a definition of dry farming taken from an article in the Nineteenth Century of June 1913 on a "rainless wheat"—wheat being a non-tropical product.

The writer of the paper, Mr. A. W. Beven, disclaims wishing to be regarded as an authority on the subject, but desires that the Agricultural Society should take the matter up and demonstrate its utility in the arid regions of this Island, both on high and low lands.

A former paper on the same subject, Mr. Beven says, elicited little interest, but Mr. Beven looks forward with confidence to the Director of Agriculture changing the "desert" region of Ceylon known as the Wanni into productive farms, vineyards and orchards, or, in more locally appropriate and every day language, into cultivated fields and gardens.

At the start some confusion has been caused by the use of the word "desert."

The writer in the Nineteenth Century analyses the expression, and I think that to apply the term "desert" to a region like the Wanni is to convey a wrong impression.

Mr. Beven further quotes the writer in the Nineteenth Century as follows :—

"Finally, desert lands are usually free from *malaria*, and are thus well suited to colonization."

Yet it is common knowledge that malaria is one of the features of the Wanni, and that this fact is the main obstacle in the way of its development, "by colonies of settlers on special terms" as Mr. Beven writes, or in any other way.

So that at the outset it looks as if proposals for "dry farming" the Wanni are scarcely relevant to the circumstances.

A standard work on the Wanni is Mr. J. P. Lewis's "Manual of the Vanni Districts."

Mr. Lewis spent a number of years of his service in the Mullaitivu and Vavoniya districts which constitute the greater part of the Wanni, which he describes as follows :—

"Bounded on the north by the Jaffna lake, on the south by the Aruvi Aar and the North Central Province, on the east by the district of Trincomalie, and on the west by the district of Mannar ; extent about 1,864 square miles ; derivations of the name (in a foot note) various, one meaning 'forest,' another 'heat,' another 'scarcity,' another 'fire,' another 'hardness of the soil' ; the longest distance from the North-east to South-west 71 miles and from East to West 60 miles ; away from the coast the country is everywhere covered with thick forest or jungle ; the rivers are rivers only in the wet season, the flow lasting from about October to January, if there is rain."

Those not personally acquainted with the Wanni will find from the Agricultural Map of the Northern Province that large areas of the Northern Wanni are unoccupied, in high forest, and pathless ; the biggest uninhabited area is about 25 miles long by 20 miles broad, and about 10,000 acres out of this will be watered by the Iranaimadu Tank, also called the Karachchi Scheme, in course of construction.

An Indian Official, MR. STRANGE, in a report of 1909 on irrigation in Ceylon, writes as follows as to colonization of the mainland in question :—

"In Jaffna, although the people are crowded, they are not likely to leave the peninsula in large numbers; they do not care to forsake their ancestral land and are afraid of the climate of the Wanni in the Northern Province, the unoccupied area nearest to them ; they dread its isolation and are afraid of the wild animals that infest it."

It is well known that whenever the Jaffna man who goes to the mainland gets fever he returns to the comfortable peninsula as fast as he can travel.

As regards wild beasts of the Wanni ; the elephant when a "rogue" is a danger to villagers and the damage done to cultivation by elephants whether herd elephants or rogues, is great ; stacks, huts, and garden trees are pulled down and inhabitants are stopped from going to or getting out of their villages ; pigs and the lesser vermin of the jungle also make great depredations on cultivation. The leopard is there in numbers, and consumes many cattle ; while the bear is a serious menace to man, because along the lonely jungle paths villagers are apt to walk on to these beasts in ant hills or moving about for honey and jungle fruit, and if the bear attacks, the villager has little chance of escape without terrible injuries, not infrequently resulting in death. Naturally these dangers and disadvantages of the jungle, all in the day's work to the Wanni man, are terrifying to the Jaffna man from the comfortable home in the tame peninsula.

Now the question is how far is it possible to develop this apparently inhospitable region ?

In the Jaffna peninsula "farm" and "farming" are common expressions, and the peninsula man is a ready made "dry farmer" who understands and practises "tilth," the essence of dry farming ; so that here you seem to have the ideal farmer or cultivator for the Wanni, if other conditions of life and cultivation were satisfactory. Moreover the peninsula man has already nibbled at the main land, for it is he who has all along cultivated the Poonaryn and Karachchi fields bordering the lagoon both sides of Elephant Pass and forming the Northern boundary of the Wanni ; and both in the peninsula and in the Poonaryn and Karachchi fields, paddy cultivation is carried on by rain water, not irrigation, and there is therefore scope for dry farming.

As to how far either dry farming or paddy cultivation in the ordinary course are possible for new settlers in the Wanni:—No question of dry farming need arise in the area under the Iranaimadu Tank adjoining the existing Karachchi fields, because there the cultivation will be by regular irrigation when the tank is completed. Whether the soil is suitable for

coconuts is not decided; I believe it is not suitable and asked MR. LYNE to have it examined but this has not yet been done ; if the soil is found suitable for coconuts, by all means let the principles of dry farming be applied; only a few estate owners plough under coconuts in the Jaffna Peninsula at present.

In addition to wild beasts and malaria, and jungle which is dense and frequently pathless and therefore not immediately attractive to new comers, there is in the Wanni a lack of sub-soil water, which is not found as in the coral formation of the peninsula near the surface ; if it were, the problem of the mainland would be much nearer solution, for the peninsula man with his market garden cultivation raised by irrigation from wells dotted all over the country is a wonderfully successful farmer and would be unlikely to withstand the attraction of the mainland if there were water as in Jaffna. But, whether you dry farm or wet farm in the Wanni you must begin by *chenaing* the forest or jungle, and raising the usual chena crops after the burn ; and it takes a few years to eradicate the roots of trees of high forest land and to prepare level field, and during those years you must have chena produce to eat, to live.

In his Essay on "Plantations" which I have had occasion to quote in the Eastern Province also, BACON advises as follows:—"In a country of plantation first look about what kind of victual the country yields of itself to hand—as pineapples, dates, wild-honey and the like—and make use of them. Then consider what victual or esculent things there are which grow speedily and within the year as maize and the like; which peas and beans you may begin, both because they ask less labour and because they serve for meat as well as for bread." Besides making one's mouth water this advice possibly represents an improved chena system suitable for the Wanni ; fruit trees may be added as they already flourish in some Wanni villages; though, even, then I cannot agree with MR. BEVEN that the time may come when irrigation will be obsolete for paddy cultivation in the Wanni.

But unless you dam the rivers which at present run to waste in the sea, and construct storage tanks on them,-to fill—*after restoration*—the hundreds of abandoned tanks dotted about all through the jungles, it is not possible for a new settler, whether capitalist or cultivator, to live at all, much less to make any profit in the Wanni ; small tanks restored by a settler run dry before a crop can be brought to maturity unless they are replenished from a storage tank; and during the years of restoration of the small tanks the settler must have the means of maintaining himself and his family ; thus *free land* is insufficient ; a *subsidy* for some years is also necessary.

Therefore the bottom question for development of the Wanni is not easy terms or free land, but first, storage scheme for water; and any one of these will cost, as the Karachchi scheme is doing, a million or two of Rupees of public money. If any capitalist or cultivator desiring to settle in the Wanni is in doubt about this argument, let him go there and see when he will certainly drop his capital or starve, or both.

As to the inhabited areas of the Wanni;—in these only could any attempt at dry farming be started as an experiment; there is Crown jungle available all round the plots of tobacco land adjoining the residing quarters and gardens. But if this jungle is granted on the easiest terms the Wanni

man must still begin by chenaing it; and, unless watched, he will assuredly extend his chena, instead of starting dry farming properly so called on the cleared area. And, at this point, I should like to know what products, exactly, it is proposed to grow in the Wanni by process of dry farming? Wheat, we know, is out of the question.

As to MR. BEVEN's point of "sufficient inducements":—

(1) A Jaffna, not Straits, Syndicate made an offer for land under the Karachchi Scheme in 1902. The terms were to be sale at an upset price of Rs. 10 per acre; annual water rate Rs. 2 per acre; prohibition to alienate the land without sanction of Government.

The Syndicate did not agree to this last condition and negotiations were broken off and when, later, the Syndicate intimated consent to the last condition, Government declined to grant any special terms in view of the opening of the railway in the near future; the negotiations had lasted till 1905. The tank will still take four or five years to complete, so that this would have been rather a long lock-up for capital.

(2) As regards MR. WICHERLEY, since referred to by MR. BEVEN:— Land in the North-Central Province was, I understand, offered to MR WICHERLEY at Rs. 30 per acre without, and Rs. 15 per acre with, competition, and the offer was not accepted; but as the object was to float a company to plant Ceara rubber, a speculative product under doubtful conditions, it seems probable that neither this Island nor the general public have lost by the failure of negotiations; potential investors have probably saved their money.

(3) In 1909 Government offered certain easy terms for the Wanni to attract settlers; these will be found published in the Gazettes of 5th February and 12th March, 1909. They naturally do not apply to the Karachchi Scheme area. The terms were offered with a view (a) to extension of cultivation under existing village tanks and (b) to restoration of breached and abandoned tanks, but as regards the latter the point is, *not easy terms, for land*; the point is, I repeat, *storage of water*. No tanks have therefore been successfully restored under these terms, for these terms, too, were not relevant to the circumstances. The terms for (a) have been availed of to some extent in the Southern Wanni by villagers of the North-Central Province, who already have relatives in the Southern Wanni, where they are not therefore strangers.

(4) In 1912 a notice was put up, at Jaffna, asking capitalists desiring to secure land other than irrigable land under the Iranaimadu tank, to communicate with the Kachcheri, but there was no response. The reason is that without water there is neither a living nor a profit in the Wanni.

(5) In the Mullaitivu Wanni two years ago the authority of Government was obtained to sell certain lands under SIR HENRY WARD's Minute, i. e., by payment in 4 yearly instalments.

So that it is not right to suggest that all the fault is the absence of sufficient inducement by Government to develop the Wanni—though it would be quite good policy to give *free* land for dry or wet farming otherwise than under irrigation works, if that course would keep new settlers alive. Under irrigation works the terms must necessarily have some relation to the expenditure by Government on tank construction.

Finally, MR. BEVEN goes too fast when he says in his speech "there are vast tracts of Ceylon in the arid regions which are uninhabited; with dry farming these places could be inhabited. If there were sufficient inducement offered the people would settle down there, and the desert places of Ceylon would in time become a smiling garden."

You cannot alter the face of nature or the conditions of life merely by the use of picturesque phrases; you cannot populate the Wanni by talking about dry farming, though we may, and I hope we shall, be able to improve—on Baconian and "dry farming" principles—the agricultural conditions round about existing villages or round new tanks; but for the bulk of the Wanni the supply of sufficient water, by the construction of storage tanks, is the only way.

This contribution to the controversy is written from the point of view of a possible settler in the Wanni rather than from that of a Government Official.

H. R. FREEMAN

Colombo, 28th November, 1913.

Note.

In a Dutch map I find the name 'Wanni' is applied to only the Mullaitivu and Vavuniya Districts, excluding the Jaffna District mainland; hence my reference at the last meeting to country south of Iranaimadu Tank. But MR. LEWIS'S boundaries are also accepted as the Wanni.

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MARKET RATES FOR TROPICAL PRODUCTS.

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		QUALITY.	Quotations.
ALOES, Socotrine	cwt.	Fair to fine	55 a 65
Zanzibar & Hepatic	,,	Common to good	40 a 65
ARROWROOT (Natal)	lb.	Fair to fine	6½d a 7d
BEES' WAX	cwt.		
Zanzibar Yellow	,,	Slightly drossy to fair	£7 10 a £7 15
East Indian, bleached	,,	Fair to good	£8 10 a £8 15
,, unbleached	,,	Dark to good genuine	£6 5 a £6 17 6
Madagascar	,,	Dark to good palish	£7 10 a £7 15
CAMPHOR, Japan	lb.	Refined	1/4½ a 1/6
China	cwt.	Fair average quality	155/
CARDAMOMS, Tuticorin		Good to fine bold	6 a 6 5
	per lb	Middling lean	5,2 a 5 7
Malabar, Tellicherry	,,	Good to fine bold	6/ a 6/3
Calicut	,,	Brownish	5/2 a 5/8
Mangalore	,,	Med Brown to good bold	5/3 a 6 6
Ceylon, Mysore	,,	Small fair to fine plump	4 7a 6/5
Malabar	,,	Fair to good	3 8 a 3 10
Seeds, E. I & Ceylon	,,	Fair to good	4/9 a 5/2
Ceylon "Long Wild"	,,	Shelly to good	1/2 a 3/2 nom
CASTOR OIL, Calcutta	,,	Good 2nds	4d nom
CHILLIES, Zanzibar	cwt.	Dull to fine bright	37 6 a 45
Japan	,,	Fair bright small	28 a 32 6
CINCHONA BARK.	lb.	Crown, Renewed	3⅜ d a 7 d
Ceylon		Org. Stem	2d a 6d
		Red Org. Stem	1⅜ d a 4 1d
		Renewed	3d a 5½d
		Root	1½d a 4d
CINNAMON, Ceylon	1sts.	Good to fine quill	1/3 a 1/7
per lb.	2nds.	,, ,,	1/2 a 1/6
	3rds.	,, ,,	1/1 a 1/5
	4ths.	,, ,,	1/ a 1/3
Chips, &c.,		Fair to fine bold	2d a 4d
CLOVES, Penang	lb.	Dull to fine bright pkd.	1/1 a 1/3
Amboyna	,,	Dull to fine	10d a 10½d
Zanzibar	,,	Fair and fine bright	5½d a 6½d
Madagascar	,,	Fair	7d
Stems	,,	Fair	3d
COFFEE			
Ceylon Plantation	cwt.	Medium to bold	Nominal
Native		Good ordinary	Nominal
Liberian	,,	Fair to bold	63 a 80
COCOA, Ceylon Plant.	,,	Special Marks	86 a 92 6
		Red to good	81 a 85
Native Estate	,,	Ordinary to red	42 a 78 6
Java and Celebes	,,	Small to good red	30s a 93s
COLOMBO ROOT	,,	Middling to good	14 a 21/
CROTON SEEDS, sifted	,,	Dull to fair	60 a 62 6
CUBEBS	,, ,,	Ord. stalky to good	135/ a 165
GINGER, Bengal, rough	,,	Fair	19/
Calicut, Cut A	,,	Medium to fine bold	60 a 75
B & C	,,	Small and medium	36/ a 60
Cochin, Rough	,,	Common to fine bold	24 a 30
		Small and D's	25/
Japan	,,	Unsplit	22
GUM AMMONIACUM		Ord. Blocky to fair clean	40s a 72s 6d
ANIMI, Zanzibar		Pale and amber, ster. srts	£14 10 a £16 10
	,,	,, ,, little red	£11 a £12
	,,	Bean and Pea size ditto	80 a £10 5
	,,	Fair to good red sorts	£8 10/ a £10 10
	,,	Med. and bold glassy sorts	£5 a £7 10
Madagascar	,,	Fair to good palish	£4 a £8
	,, ,,	red	£4 a £7
ARABIC, E. I. & Aden	,,	Ordinary to good pale	28/ a 32/ nom
Turkey sorts	,,		31/ a 55/
Ghatti	,,	Sorts to fine pale	18 6 a 32 6 nom
Kurrachee	,,	Reddish to good pale	25 a 30s nom
Madras	,,	Dark to fine pale	22 6 a 29 6 nom
ASSAFŒTIDA	,,	Clean fr to gd. almonds	£7 a £8
		com. stony to good block	40s a £5 1 2,6
KINO	lb.	Fair to fine bright	6d a 1 5
MYRRH, Aden sorts	cwt.	Middling to good	55/ a 65/
Somali	,,	,, ,,	45s a 50s
OLIBANUM, drop		Good to fine white	45s a 50s
	,,	Middling to fair	35s a 40s
pickings	,,	Low to good pale	15 a 27 6
siftings	,,	Slightly foul to fine	18 a 21s
INDIA RUBBER	lb.	Fine Para smoked & sheets	2/5½
Ceylon, Straits,	,,	Crepe ordinary to fine	2/2 a 2/2½
Malay Straits, etc.	,,	Fine Block	2/1⅞
	,,	Scrap fair to fine	1/5 a 1/7
	,,	Plantation	1/10
Assam	,,	Fair 1/1 to ord. red No. 1.	1/3 a 1/6
	,,	,, ,, ,, ,,	1/2 a 1/4
Rangoon	,,		
	,,		

		QUALITY.	QUOTATIONS.
INDIARUBBER	lb.		
Borneo	,,	Common to good	9d a 1/2
Java	,,	Good to fine red	1/4 a 1/5
Penang	,,	Low white to prime red	9 d a 1/3
Mozambique	,,	Fair to fine red ball	1/10 a 2/2
	,,	Sausage, fair to good	1/9 a 2/1
Nyassaland	,,	Fair to fine ball	1/9 a 2/1
Madagascar	,,	Fr to fine pinky & white	1/6 a 1/9
	,,	Majunga & blk coated	1/ a 1/3
	,,	Niggers, low to good	6d a 1/6
New Guinea	,,	Ordinary to fine ball	1/6 a 1/8
INDIGO, E.I. Bengal	,,	Shipping mid to gd. violet	3s a 3s 6d
	,,	Consuming mid. to gd.	2s 6d a 2s 11d
	,,	Ordinary to middling	2s 3d a 2s 5d
	,,	Mid. to good Kurpah	1s 10d a 2s 5d
	,,	Low to ordinary	1s 6d a 1s 9d
	,,	Mid. to fine Madras	1/9 a 2/3
MACE, Bombay & Penang		Pale reddish to fine	2/4 a 2/6
per lb.		Ordinary to fair	2/ a 2/2
Java		,, ,, good pale	2/1a 2/4
Bombay		Wild	1/
NUTMEGS,	lb.		
Singapore & Penang	,,	64's to 57 s	9½d a 10½d
		80's	7½d
		110's	6½d
NUTS, ARECA	cwt.	Ordinary to fair fresh	17 6 a20
NUX VOMICA, Cochin		Ordinary to good	9 a 12
per cwt. Bengal		,, ,,	8/9
Madras		,, ,,	8/6 a9/6
OIL OF ANISEED	lb.	Fair merchantable	6/5
CASSIA	,,	According to analysis	3/ a 3/4
LEMONGRASS	oz.	Good flavour & colour	2½d
NUTMEG	,,	Dingy to white	1⅝d a 1 ⅞d
CINNAMON	,,	Ordinary to fair sweet	3½d a 1s 5d
CITRONELLA	lb.	Bright & good flavour	1/9
ORCHELLA WEED	cwt		
Ceylon	,,	Fair	10 Nom
Madagascar	,,	Fair	10 ,,
Zanzibar	,,	Fair	10 ,,
PEPPER—(Black)	lb.		
Alleppy & Tellicherry		Fair	5½d a 5½d
Ceylon	,,	Fair to fine bold heavy	5½d a 5⅝d
Singapore	,,	Fair	5⅝d
Acheen & W. C. Penang		Dull to fine	5d a 5½d
(White) Singapore	,,	Fair to fine	8¼d a 9d
Siam	,,	Fair	8½d
Penang	,,	Fair	7⅞d
Muntok	,,	Fair	9¼d
RHUBARB, Shenzi	,,	Ordinary to good	3/ a 4/
Canton	,,	Ordinary to good	2/6 a 3/6
High Dried	,,	Fair to fine flat	1/ a 1/2
		Dark to fair round	9 d a 11d
SAGO, PEARL, large--cwt		Fair to fine	18/
medium	,,	,, ,,	17/
small	,,	,, ,,	13/ a 15/
Flour	,,	Good pinky to white	11/ a 12/
SEEDLAC	cwt.	Ordinary to gd. soluble	65/ a 85/
SENNA, Tinnevelly	lb.	Good to fine bold green	5½d a 8½d
		Fair greenish	3½ d a 4½d
		Common specky & small	2d
SHELLS, M. o' PEARL			
Egyptian	cwt.	Small to bold	90 a £9 2 6
Bombay	,,	,, ,,	80/ a £9 7 6
Mergui	,,	Chicken to bold	10 17 6 a 14 2 6
Manilla	,,	Fair to good	£9 a £14 17 6
Banda	,,	Sorts	75 a 92 6
Green Snail	,,	Small to large	60/ a 100/
Japan Ear	,,	Trimmed selected small to bold	72 6 a £9 5
TAMARINDS, Calcutta		Mid to fine bl'k not stony	13/
per cwt Madras		Inferior to good	6/ a 10/
TORTOISESHELL			
Zanzibar, & Bombay	lb.	Small to bold	11/ a 31/
		Pickings	12/ a 22/
		Fair	15/ nom
TURMERIC, Bengal	cwt.	Finger fair to fine bold	15/ a 17/
Madras	,,	Bulbs ,, ,, bright	12/ a 13/
Do.	,,	Finger fair	14 a 15/ nom.
Cochin	,,	Bulbs ,,	12/
VANILLOES	lb.		
Mauritius)	1sts.	Gd. crystallized 3½a 8½a in.	11 6 a 16
Madagascar ...)	2nds.	Foxy & reddish 3½a ,,	11/ a 12,6
Seychelles ...)	3rds.	Lean and inferior	10 6 a 11 6
VERMILLION ...		Fine, pure, bright	2/9
WAX, Japan, squares		Good white hard	48/

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